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HERBERT HOOVER, SECRETARY

BUREAU OF MINES
SCOTT TURNER, DIRECTOR

MINERAL RESOURCES
OF THE
UNITED STATES
1924

FRANK J. KATZ
Chief Engineer, Division of Mineral Resources and Statistics

PART II—NONMETALS

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MINERAL RESOURCES OF THE UNITED STATES, 1924—PART II

SULPHUR AND PYRITES

By Helena M. Meyer[1]

SULPHUR

PRODUCTION

The conditions in the sulphur industry were substantially the same in 1924 as in 1923. While production decreased 40 per cent during the year, from 2,036,097 to 1,220,561 long tons, shipments decreased only 5 per cent, from 1,618,841 to 1,537,345 tons. For the first time since 1920 the shipments were thus larger than the production, and with the exception of those for 1923 they were the largest ever recorded. The excess of shipments over production was drawn from stocks, which at the end of 1923 had reached the unprecedented total of 3,000,000 tons. This left 2,700,000 tons on hand at the mines at the end of 1924, a decrease of 10 per cent. Stocks, however, are still large enough to carry on record shipments, with the mines shut down, for nearly two years. The estimated value of shipments in 1924 is $25,000,000, compared with $26,000,000 for 1923, at approximately the same rate per ton.

As usual, the Texas Gulf Sulphur Co. and the Freeport Sulphur Co., of Texas, and the Union Sulphur Co., of Louisiana, produced practically the entire output.

On December 23, 1924, all operations stopped at the deposit of the Union Sulphur Co. in Calcasieu Parish, La., owing to the exhaustion of the ore. The development of this deposit, which has been producing sulphur for 25 years, overthrew by cheaper production the domination of the sulphur markets by the Sicilian deposits. Exploitation of this deposit was made difficult by quicksands but was finally, after many unsuccessful attempts, achieved by what is known as the Frasch process, devised by Herman Frasch, the founder of the Union Sulphur Co. By the adoption of this process the United States reached its present place as the leading sulphur-producing country of the world. The Union ore body has yielded about 10,000,000 tons of sulphur. The company expects soon to begin operations on a new large proved deposit of sulphur, called the Union Mound, about 9 miles from the town of Richmond, in Fort Bend County, Tex. It also owns another deposit in Calcasieu Parish, La., which, however, will not be worked for some time.

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[1] Figures of imports and exports compiled by J. A. Dorsey, of the United States Geological Survey, from records of the Bureau of Foreign and Domestic Commerce.

The agreement between the American producers and the Sicilian Sulphur Consortium, described in Mineral Resources for 1922 and 1923, has apparently aided the Sicilian producers. Prior to the World War the annual production of sulphur in Sicily averaged over 340,000 long tons. The production during and since the war has decreased materially, owing largely to the increased competition for European markets by cheaply produced American sulphur from Louisiana and Texas mines. The historical table on page 3 shows the tremendous increase in recent years in the exports of sulphur from the United States.

In 1922 the production of sulphur in Sicily had dwindled to 135,000 long tons, but in 1923 it increased to 203,000 long tons, and in 1924 it amounted to 220,000 long tons.

From 1880 through 1903 an average annual production of 2,800 long tons of sulphur was made, starting with over 500 tons in 1880 and approximating 25,000 tons in 1903.

Sulphur produced and shipped in the United States, 1904–1924

Year	Produced (long tons)	Shipped		Year	Produced (long tons)	Shipped	
		Long tons	Approximate value			Long tons	Approximate value
1904	85, 000	60, 000	$1, 256, 000	1915	520, 582	293, 803	$4, 959, 000
1905	220, 000	162, 000	3, 305, 000	1916	649, 683	766, 835	12, 246, 000
1906	295, 123	185, 082	3, 207, 000	1917	1, 134, 412	1, 120, 378	23, 987, 000
1907	188, 878	271, 859	4, 771, 000	1918	1, 353, 525	1, 266, 709	27, 868, 000
1908	364, 444	206, 473	3, 727, 000	1919	1, 190, 575	678, 257	10, 252, 000
1909	273, 983	258, 203	4, 782, 000	1920	1, 255, 249	1, 517, 625	30, 000, 000
1910	247, 060	250, 919	4, 522, 000	1921	1, 879, 150	954, 344	17, 000, 000
1911	205, 066	253, 795	4, 573, 000	1922	1, 830, 942	1, 343, 624	22, 000, 000
1912	787, 735	305, 390	5, 289, 000	1923	2, 036, 097	1, 618, 841	26, 000, 000
1913	491, 080	319, 333	5, 617, 000	1924	1, 220, 561	1, 537, 345	25, 000, 000
1914	417, 690	341, 985	6, 214, 000				

IMPORTS AND EXPORTS

The imports of "sulphur and sulphur ore" in 1924 amounted to 1,005 long tons, valued at $40,293. The exports of sulphur or brimstone from the United States in 1924 were 482,114 long tons, an increase of 9,589 tons, and with the exception of those in 1922 were the highest ever recorded. The exports of refined and sublimed sulphur and flowers of sulphur were 2,029 tons, making a total of exports of crude and refined sulphur of 484,143 tons in 1924, compared with 474,475 tons in 1923. The imports of crude sulphur increased from 87,837 long tons in 1880 to 188,990 tons in 1903, the highest recorded, and averaged 126,000 tons for the period 1880–1903. The exporting of sulphur did not begin until 1904.

Crude sulphur imported for consumption in and exported from the United States, 1904–1924, in long tons

Year	Imports	Exports	Year	Imports	Exports
1904	127,996	[a] 3,000	1915	24,647	37,312
1905	82,961	11,522	1916	21,289	128,755
1906	72,404	22,237	1917	973	152,736
1907	20,399	35,925	1918	55	131,092
1908	19,620	27,894	1919	77	224,712
1909	28,800	37,142	1920	44	477,450
1910	28,656	30,742	1921	4	285,762
1911	24,200	28,103	1922	[b] 167	485,664
1912	26,885	57,736	1923	[c] 465	472,525
1913	15,122	89,221	1924	[c] 1,005	482,114
1914	23,610	98,163			

[a] Exports of sulphur not separately classified in the Bureau of Foreign and Domestic Commerce prior to 1905. In Mineral Resources, 1904, p. 1079, J. H. Pratt says that in 1904 the first cargo of American sulphur, 3,000 tons, was exported from Louisiana to Marseille, France.

[b] Composed of 130 tons of "crude sulphur," imported Jan. 1 to Sept. 21, and 37 tons of "sulphur and sulphur ore" imported Sept. 22 to Dec. 31.

[c] Classified as "sulphur and sulphur ore."

Although the customs districts from which crude sulphur was cleared in 1924 are distributed around the entire border of the country, practically all the sulphur exported was produced by the large mines in Texas and Louisiana.

Sulphur exported from the United States in 1924, by destination

Destination	Sulphur or brimstone		Refined, sublimed, and flowers of	
	Long tons	Value	Pounds	Value
North America:				
Canada	119,221	$1,921,585	1,769,984	$34,807
Central America	81	3,865	192,739	5,617
Mexico	7,140	116,998	1,428,529	30,436
Newfoundland and Labrador			2,435	136
West Indies and Bermuda	2,536	36,875	112,026	3,575
	128,978	2,079,323	3,505,713	74,571
South America:				
Argentina	7,360	117,011		
Brazil	2,131	33,039	144	11
Colombia	30	1,444	117,075	4,040
Other	924	24,681	232,994	4,713
	10,445	176,175	350,213	8,764
Europe:				
Belgium	3,502	58,413		
England	36,458	591,424	14,348	1,331
Finland	6,300	95,300		
France	92,918	1,527,833	4,108	112
Germany	79,906	1,358,474		
Netherlands	21,305	358,059	1,510	144
Norway	1,304	19,560		
Spain	9,689	155,353		
Other	7,627	110,432		
	259,009	4,274,848	19,966	1,587
Asia	40	1,500	130,921	2,782
Africa:				
Algeria and Tunis	7,550	121,700		
British South Africa	5,000	85,000	604	50
	12,550	206,700	604	50
Oceania:				
Australia	58,827	882,598	443,842	11,225
New Zealand	12,265	171,710	94,750	2,368
	71,092	1,054,308	538,592	13,593
	482,114	7,792,854	4,546,009	101,347

Of the total crude sulphur exported, European countries, headed by France, Germany, England, and Netherlands, received 54 per cent. Canada received 25 per cent, which was the largest amount shipped to any one country. Australia received 12 per cent and New Zealand nearly 3 per cent. Although the total exports of crude sulphur in 1924 increased over those in 1923, the quantities exported to many of the leading countries showed decreases. Exports to Canada decreased from 127,971 to 119,221 long tons, to France from 98,827 to 92,918 tons, and to Germany from 83,821 to 79,906 tons. Exports to England increased from 29,953 to 36,458 tons, to Netherlands from 8,555 to 21,305 tons, to Australia from 50,530 to 58,827 tons, and to New Zealand from 10,750 to 12,265 tons.

The exports of refined, sublimed, and flowers of sulphur went mainly to Canada and Mexico, which received over 3,000,000 pounds out of a total of 4,546,009 pounds.

PYRITES

The domestic pyrites market did not change in 1924. The companies that produced pyrites in 1923 continued operations in the same States. The combined production of California and Virginia was 152,309 long tons, New York produced 7,593 tons, Ohio 73 tons, and Wisconsin 121 tons. The total production was thus 160,096 long tons, valued at $645,262, compared with 181,628 tons, valued at $661,000, in 1923, a decrease of 12 per cent in quantity and 2 per cent in value.

Although the production of pyrites dropped 12 per cent in 1924, the quantity sold and consumed by producing companies dropped only 6 per cent, from 170,997 tons in 1923 to 160,075 tons in 1924.

The total sulphur content of lump and fines produced in 1924 was equivalent to 66,459 tons, which would indicate an average content of 41.5 per cent, compared with 41.3 per cent in 1923.

The table below shows the production of pyrites since 1904. A study of the historical table of imports in connection with this table shows that both production and imports have decreased substantially during recent years, indicating a large decrease in the demand for pyrites. The production in 1924 was the smallest recorded since 1897, except that in 1921, when 157,118 tons was produced; and the imports in 1924 were the smallest recorded since 1896, except those for the same year. In the five-year period 1909–1913 production plus imports of pyrites averaged 1,160,000 tons a year, compared with 407,000 tons in 1924.

The production of pyrites increased from about 2,000 tons in 1880 to more than 200,000 tons in 1903. Figures for 1904 through 1924 are shown in the following table:

Pyrites produced in the United States, 1904–1924

Year	Long tons	Value	Year	Long tons	Value
1904	207, 081	$814, 808	1915	394, 124	$1, 674, 933
1905	253, 000	938, 492	1916	439, 132	2, 038, 002
1906	261, 422	931, 305	1917	482, 662	2, 593, 035
1907	247, 387	794, 949	1918	464, 494	2, 644, 515
1908	222, 598	857, 113	1919	420, 647	2, 558, 172
1909	247, 070	1, 028, 157	1920	310, 777	1, 596, 961
1910	241, 612	977, 978	1921	157, 118	711, 432
1911	301, 458	1, 164, 871	1922	169, 043	671, 241
1912	350, 928	1, 334, 259	1923	181, 628	661, 000
1913	341, 338	1, 286, 084	1924	160, 096	645, 262
1914	336, 662	1, 283, 346			

In addition to the pyrites reported above for 1924, 8,756 tons of partly desulphurized tailings from the roasting and separating operations of the National Zinc Separating Co.'s plant at Cuba City, Wis., were re-treated by auto-roasting, and the fumes were recovered for the production of sulphuric acid.

In 1924 Ed. Hill and R. E. Culver, of Poland Junction, Ariz., shipped 3,105 pounds of pyrites, for which they received $1,617, to a Detroit radio company. In addition, the South Ibex Mines Co., of Leadville, Colo., shipped 3,417 pounds of pyrites for radio uses from its Garbutt and Nonie mines, for which it received $3,417. The names of other shippers of pyrites for radio uses, if there were any, are not known.

The imports of pyrites decreased from 263,695 long tons in 1923 to 246,737 tons in 1924. In 1884 the imports of pyrites were 16,710 long tons, and in 1903 they had increased to 420,410 tons. The imports for 1904 through 1924 are shown below:

Sulphur ore as pyrites, containing more than 25 per cent of sulphur, imported for consumption in the United States, 1904–1924

Year	Long tons	Year	Long tons
1904	422, 720	1915	964, 634
1905	511, 946	1916	1, 244, 662
1906	598, 078	1917	967, 340
1907	627, 985	1918	496, 792
1908	668, 117	1919	388, 973
1909	688, 843	1920	332, 606
1910	803, 551	1921	216, 229
1911	1, 006, 310	1922	279, 445
1912	970, 785	1923	263, 695
1913	850, 592	1924	246, 737
1914	1, 026, 617		

FULLER'S EARTH

By Jefferson Middleton

GENERAL CONDITIONS

The fuller's earth industry in 1924, on the whole, was in a highly prosperous condition. The industry—a comparatively small one—has advanced steadily since 1912 except in one year, 1921, and the output of 13 operators in 6 States in 1924 was 177,994 short tons, valued at $2,632,342. This quantity was 19 per cent greater than that of 1923 and more than four times that of 1914. The value of the output for 1924 was also the largest ever recorded. It was 17 per cent greater than that of 1923, 5 per cent greater than that of 1920, previously the year of greatest value, and more than six times that of 1914. Since 1920 there has been a steady decline in the average value per ton of fuller's earth, the value in 1924—$14.79—being nearly $5 lower than that of 1920, the year of highest average. The average value per ton in 1924 was higher than that of any year prior to 1919. Imports continued to decrease and in 1924 were the lowest in quantity since 1897.

Notwithstanding the large growth of this industry the producers of natural fuller's earth are confronted with what may be serious competition in the peculiar claylike materials of California, Nevada, Utah, and possibly other far western States, which are known locally as bentonite, Death Valley clay, leverrierite, montmorillonite, etc., and which are said to be superior to the natural earth after treatment with sulphuric acid under a patented process.

The Engineering and Mining Journal-Press of November 15, 1924, contained a paper on the marketing of fuller's earth, by Arthur B. Parsons, which gives much information of general interest on the subject. This paper appeared subsequently as a chapter in a volume entitled "The marketing of metals and minerals." It includes typical analyses of fuller's earth, a list of materials on which the earth is used in refining, and sections on methods of use, prices, properties, sampling, shipping methods, specifications, tariff, uses, and other pertinent subjects.

OCCURRENCE

Fuller's earth has been reported as occurring in Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Illinois, Massachusetts, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New York, Pennsylvania, South Carolina, South Dakota, Texas, Utah, Virginia, and Washington, but in 1924 it was produced only in Alabama, Florida, Georgia, Illinois, Massachusetts, and Texas.

USES

Fuller's earth is used principally as a filtering medium in the clarifying or bleaching of fats, greases, and mineral and vegetable oils.

Its original use was in the fulling of cloth, from which it derived its name. This use, however, at least in this country, has almost been abandoned. Fuller's earth is also said to be used in the manufacture of pigments for printing wall paper, in detecting certain coloring matters in some food products, as a substitute for talcum powder, and in medicine as a poultice and as an antidote for alkaloid poisons. Another suggested use is in deliming hides in the manufacture of leather. It has also been stated that the fuller's earth cake from oil mills can be used in the manufacture of hand soaps, concrete, waterproofing, and asphalt preparations.[1]

HISTORY

Fuller's earth was first discovered in the United States in 1891 near Alexander, Ark., by John Olsen. This earth was used for a time by the Southern Cotton Oil Co., at Little Rock, Ark., but its use was finally abandoned.[2] The real beginning of the industry in this country, however, was in 1893, near Quincy, Fla., when quite by accident, in an unsuccessful effort to burn brick on the property of the Owl Cigar Co., an employee called attention to the close resemblance between the clay used and the German fuller's earth. This discovery in Florida caused considerable excitement, and deposits of fuller's earth were reported from a number of States, but the material in most of these deposits was found to have no value as fuller's earth. Production began in Florida almost immediately after the discovery, and in 1897–1899 fuller's earth was produced in Florida, Colorado, New York, and Utah, with Florida the leading producer, a rank that it has maintained continuously until 1924. In 1901 Arkansas again became a producer. From 1904 to 1907 Arkansas was the second largest producer. Fuller's earth was found in Georgia soon after its discovery in Florida, but Georgia did not become a producer until 1907, when it was the third largest producing State, and it has ranked second since 1909, except in 1918 and 1919, when Texas was second, and in 1924, when it ranked first. In 1904 Alabama and Massachusetts, in 1907 South Carolina and Texas, in 1909 California, in 1918 Nevada, and in 1922 Illinois and Pennsylvania first appeared as producers.

PRODUCTION

Domestic fuller's earth sold in 1917–1924

Year	Operators reporting sales	Short tons	Value at mines	
			Total	Average
1917	11	72, 567	$772, 087	$10. 64
1918	14	84, 468	1, 146, 354	13. 57
1919	10	106, 145	1, 998, 829	18. 83
1920	12	128, 487	2, 506, 189	19. 51
1921	12	105, 609	1, 973, 848	18. 69
1922	15	138, 944	2, 289, 719	16. 48
1923	15	149, 134	2. 247, 523	15. 07
1924	13	177, 994	2, 632, 342	14. 79

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[1] Chem. and Met. Eng., vol. 26, No. 13, p. 602, Mar. 29, 1922.

[2] Branner, J. C., An early discovery of fuller's earth in Arkansas: Am. Inst. Min. Eng. Trans., vol. 43, pp. 520–522, 1913.

The small number of producers in some States makes it impossible to publish totals for those States without disclosing individual operations. Nearly all the earth produced in 1924 came from the Southern States, but three operators reported in other States—two in Illinois and one in Massachusetts. For the first time since the inception of the industry the output of Florida was exceeded by that of another State—Georgia.

IMPORTS AND EXPORTS

The imports of fuller's earth, which at one time constituted the entire supply, were increasing before the World War and reached their maximum in 1914. Since 1914, except in 1917, 1920, and 1922, there has been a steady decline in imports, the quantity in 1924 being the lowest since 1897. Owing, however, to the higher prices prevailing in later years the value of the imports in 1924 was not so low comparatively but was the lowest since 1904. Wrought or manufactured earth represented in 1924 about 96 per cent of the quantity and value of imports.

Fuller's earth imported for consumption in the United States, 1918–1924[a]

Year	Unwrought or unmanufactured			Wrought or manufactured			Total		
	Short tons	Value		Short tons	Value		Short tons	Value	
		Total	Average		Total	Average		Total	Average
1918	1,085	$12,636	$11.65	15,837	$213,599	$13.49	16,922	$226,235	$13.37
1919	373	4,301	11.53	13,500	185,410	13.73	13,873	189,711	13.67
1920	1,518	19,793	13.04	17,497	202,100	11.55	19,015	221,893	11.67
1921	483	6,172	12.78	9,261	113,243	12.23	9,744	119,415	12.26
1922	607	7,413	12.21	9,962	128,282	12.88	10,569	135,695	12.84
1923	642	8,252	12.85	7,905	105,692	13.37	8,547	113,944	13.33
1924	296	3,385	11.44	7,006	89,103	12.72	7,302	92,488	12.67

[a] The figures showing imports were compiled by J. A. Dorsey, of the United States Geological Survey, from records of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

The Department of Commerce does not report exports of fuller's earth, but five operators reported that about 6,300 tons of fuller's earth was exported to Belgium, Canada, Denmark, France, Germany, Great Britain, Greece, India, Mexico, Netherlands, Poland, and South America. This is an increase of 70 per cent over the exports in 1923, the first year for which information was obtained from producers concerning exports of fuller's earth. The figures would indicate a domestic consumption in 1924 of about 179,000 tons, of which about 96 per cent was domestic earth.

PEAT

By K. W. COTTRELL

Production and sales of peat were reported by 23 companies in the United States in 1924, one more than in the preceding year. Others, not producing peat commercially, were engaged in experimental work. The total quantity of peat produced was 55,469 short tons, valued at $395,470, a decrease of 10 per cent in quantity from 1923, but an increase of 5 per cent in value. The average price was $7.13 a ton, as against $6.14 in 1923 and $6.55 in 1922. The peat sold for use as fertilizer or as an ingredient of fertilizer amounted to 55,196 tons, valued at $387,319, a decrease of 5 per cent in quantity from 1923 but an increase of 10 per cent in value. The average prices per ton for this peat differed but little from those of all the peat sold during the corresponding years. The quantity of peat sold for use as fuel and as an ingredient in stock food was small.

The plants reporting the production of peat in 1924 were distributed as follows: New Jersey, 5; California, Florida, and New York, 3 each; Illinois, Maine, and Michigan, 2 each; Indiana, New Hampshire, and Pennsylvania, 1 each.

New Jersey was the largest producer, with an output of 23,523 tons, valued at $172,863, an increase of 28 per cent in quantity and of 60 per cent in value. Illinois ranked second, but the State total may not be published, as there were only two producers. Both quantity and value, however, were less than in 1923. California ranked third, with an output of 7,084 tons, valued at $67,952, a decrease of 13 per cent in quantity and of 8 per cent in value.

Peat produced in the United States, 1920–1924, by uses

Year	Fertilizer and fertilizer ingredient		Other products [a]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1920	63, 272	$773, 635	9, 932	$148, 097	73, 204	$921, 732
1921	29, 460	251, 046	946	9, 073	30, 406	260, 119
1922	57, 747	369, 165	2, 933	28, 564	60, 680	397, 729
1923	57, 907	351, 641	3, 448	25, 193	61, 355	376, 834
1924	55, 196	387, 319	273	8, 151	55, 469	395, 470

[a] Chiefly stock food; includes also fuel, moss, stable litter, and packing material.

Peat moss imported for consumption in the United States, 1919–1924 [a]

Year	Short tons	Value	Year	Short tons	Value
1919	464	$16, 345	1922	4, 805	$33, 034
1920	2, 762	36, 201	1923	5, 973	43, 184
1921	3, 450	22, 754	1924	5, 541	47, 208

[a] Compiled by J. A. Dorsey, of the United States Geological Survey, from records of the Bureau of Foreign and Domestic Commerce.

The following individuals and companies reported to the Geological Survey that they produced peat in the United States in 1924:

Alphano Corporation, 2 Rector Street, New York, N. Y.
American Humus Co., Guardian Building, Cleveland, Ohio.
Ammoniate Products Corporation, 2 Rector Street, New York, N. Y.
Blaine, J. H., Hopewell Junction, N. Y.
Chapman, I. S. & Co. (Inc.), 101 South E Street, San Bernardino, Calif.
Craig, William N., Fishkill, N. Y.
Dow, Fred T., Bangor, Me.
Dundee Fertilizer Co., Tampa, Fla.
Florida Humus Co., Zellwood, Fla.
Green Fly Humus Co., Fishkill, N. Y.
Humus Natural Manure Co., 1964 Broadway, New York, N. Y.
Hyper-Humus Co., Newton, N. J.
Keystone Humus Co., Hartstown, Pa.
Loskamp, P., Stockton, Calif.
Manito Chemical Co., Peoria, Ill.
Marcrum, J. G., Netcong, N. J.
Moore & Berry (Inc.), Milford, N. H.
Peat Humus Co., Huntington Beach, Calif.
Sims, Alfred F., Sag Harbor, N. Y.
Sodus Distributing Co., Benton Harbor, Mich.
Standard Agricultural Chemical Corporation, 2 Rector Street, New York, N. Y.
Steenburg, W. C., South Bend, Ind.
Wiedmer Chemical Co., Pierce Building, St. Louis, Mo.

GRAPHITE

By Jefferson Middleton

INTRODUCTION

The graphite industry in the United States suffered a considerable setback in 1924, when the number of active operators, the output, and the value all decreased. In Alabama, which showed the greatest development in response to the war demand and was for many years the leading producer, the industry has almost ceased to exist. Many, if not most of the plants that were established there have been abandoned or dismantled on account of their inability to produce graphite in competition with the cheap foreign supply, in spite of the tariff of 1½ cents a pound on imported crystalline flake graphite. In Texas, the only other State producing crystalline graphite, production was also curtailed by enforced idleness for the greater part of the year. The increased price of graphite in 1924—the most interesting feature of the year in the industry—may stimulate domestic production, but it is doubtful whether the industry will be permanently resuscitated. Imports also decreased, as did the production of artificial graphite.

The Engineering and Mining Journal-Press of June 28, 1924, published a paper on the marketing of graphite, by Charles Pettinos, which gives much interesting information on that subject. This paper appeared later as a chapter in "The Marketing of Metals and Minerals." It includes descriptions of the various kinds and grades of graphite, methods of preparation for the market, shipping methods, uses, and other pertinent subjects.

USES

Natural graphite is used chiefly in the manufacture of crucibles, lubricants, pencils, foundry facing, paints, stove polish, and dry batteries. Small quantities are also used in electrotyping and as a preventive of boiler scale. The large consumption of graphite for the manufacture of crucibles seems to be threatened by the decreasing demand for crucibles through the increasing use of electric furnaces. The percentages of consumption in the various industries in recent years have been estimated as follows: Crucibles, 45 per cent; lubricants, 10 per cent; pencils and paints, 5 per cent; foundry facing and stove polish, 30 per cent; other uses, 10 per cent.

PRODUCTION

The sales of domestic graphite in the United States fell from 6,038 short tons in 1923 to 4,971 tons in 1924, a decrease of 18 per cent. This decrease was entirely in the crystalline variety, which declined 2,164,575 pounds, or 55 per cent. The amorphous variety increased slightly in output—15 tons—compared with 1923. Crystalline graphite was produced in only two States in 1924, Alabama and Texas; in Montana only assessment work was done on the deposit near Dillon, Beaverhead County.

Domestic natural graphite sold in the United States, 1920–1924

Year	Number of active operators reporting	Amorphous		Crystalline	
		Short tons	Value	Pounds	Value
1920	17	4,694	$49,758	9,632,360	$576,444
1921	8	1,842	20,860	1,189,523	75,664
1922	7	2,200	([a])	1,849,766	85,242
1923	7	4,056	39,560	3,964,900	151,434
1924	5	4,071	38,533	1,800,325	48,977

[a] The United States Geological Survey was not at liberty to publish value.

MANUFACTURED GRAPHITE

Graphite is manufactured by the Acheson Graphite Co., at Niagara Falls, N. Y. The figures given below are published by permission of this company.

Graphite manufactured by the Acheson Graphite Co., 1919–1924, in pounds

1919	8,163,177	1922	13,031,926
1920	7,399,749	1923	26,761,015
1921	5,888,000	1924	10,986,192

PRICES

In 1924 the average value of domestic crystalline graphite at the mine was between 2 and 3 cents a pound, compared with 3 to 6.4 cents in 1923 and 4 to 5 cents in 1922.

The following table is based on information supplied by importers prior to 1920. Since then the figures have been furnished by Charles Pettinos, of New York, to whom the writer is also indebted for the following information concerning the foreign situation.

Average prices of Ceylon graphite c. i. f. New York, 1915–1924

[Cents per pound]

Year	Lump		Chip		Dust		Remarks
	First grade	Second grade	First grade	Second grade	First grade	Second grade	
1915	9⅝–20	8 –14	7 –14	6½–12	7½– 9½	6½– 9½	Low first half; high second half.
1916	20 –28	14 –21	13½–20	11½–17	9½–12	9½–10	Do.
1917	28 –32	21 –23	20 –23	17 –19	11 –13	10 –12	High level maintained throughout the year.
1918	15¼–28½	14 –22	12½–21½	11 –18½	10½–12	9 –10	High first half; low second half.
1919	14 –15¼	12 –13	10 –11	8 – 9	6¾– 7½	5 – 6	Low throughout the year.
1920	9 –14	7 –11	7 –10	5½– 7½	5 – 7	3½– 5	High first half; low second half.
1921	5½– 6	4½– 5	4½– 5	3½– 4	3¼– 3¾	2 – 2½	Low throughout the year.
1922	5 – 6	4 – 4½	3¾– 4¼	3¼– 3¾	3 – 3½	2 – 2½	Do.
1923	5 – 6	4 – 4½	3¾– 4¼	3¼– 3¾	3 – 3½	2 – 2½	Do.
1924	5½– 7	4½– 6	4 – 6	3½– 5	3¼– 4½	2 – 3	Low first three-quarters; high last quarter.

Prices remained on a low level throughout the first three-quarters of the year and did not reach the high level until the last quarter. They were lowest in the first two months of the year, but advanced gradually through the spring and summer. This advance was more or less in sympathy with the rise in price of Madagascar graphite, to which reference will be made. In September and October Ceylon graphite increased rapidly to a price that it has since maintained. The causes leading to the increases were as follows:

Foreign conditions.—For several years, in fact since the armistice, the graphite markets in Ceylon and Madagascar have been very low, with prices nominal and large quantities of the old war stock on hand; hence there was little or no mining in either island, and the surplus stocks were on the market at whatever price they would bring. Early in 1924 the trade—especially in Europe—realized that these old stocks were almost exhausted and a concerted buying campaign began, although the demand had not increased or the business quickened. This competitive buying, especially in Madagascar, quickly raised prices and the old supply was promptly bought. When the price was high enough to make their mining profitable, some of the old pits were opened and graphite was put on the market in limited quantities. After the Madagascar supplies were exhausted similar conditions developed in Ceylon. The price of graphite increased in Madagascar in the spring and in Ceylon in the fall.

Madagascar flake graphite sold in January and February, 1924, on a basis of about 800 francs for 1,000 kilos, c. i. f. New York, duty not included. Before the end of the year it sold as high as 1,800 francs. Duty added brought the price to about 6 cents a pound.

IMPORTS AND EXPORTS

The reports of the Bureau of Foreign and Domestic Commerce as to imports show only the country from which the graphite is shipped, which is not always the country of origin. For instance, the graphite entered in the table as imported from France probably originated in Madagascar, and that imported from Great Britain should probably be credited to Ceylon and possibly in part to Madagascar. The shipments from Japan probably consisted of graphite from Chosen.

In 1924 the imports of graphite for consumption decreased 3,059 tons, or 16 per cent, and $214,608, or 35 per cent, compared with 1923.

Graphite imported for consumption in the United States, 1920–1924, by kinds

Year	Amorphous		Crystalline chip or dust		Crystalline flake		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1920	([a])	([a])	([a])	([a])	([a])	([a])	21, 095	$1, 711, 312
1921	([a])	([a])	([a])	([a])	([a])	([a])	8, 183	452, 076
1922	([a])	([a])	([a])	([a])	([a])	([a])	12, 488	473, 046
1923	11, 252	$149, 831	7, 243	$426, 417	939	$37, 871	19, 434	614, 119
1924	10, 936	113, 751	3, 998	197, 867	1, 441	87, 893	16, 375	399, 511

[a] Not separately classified prior to 1923.

Graphite imported into the United States, 1919–1924

[General imports]

Country	1919		1920		1921	
	Short tons	Value	Short tons	Value	Short tons	Value
Austria			58	$1, 195		
Canada	1, 504	$102, 163	2, 170	157, 015	687	$48, 035
China			2	114	1	95
Chosen					15	203
Colombia					9	676
England	847	157, 390	1, 354	190, 414	51	5, 241
France	1, 129	166, 662	2, 243	167, 580	1, 078	67, 506
French-Indo China	8, 512	1, 000, 000			(a)	3
Germany			30	2, 502		
Hongkong	(a)	10	11	601	(a)	4
India:						
British			156	36, 547	(a)	22
Other British East	8, 604	1, 372, 891	7, 694	850, 329	2, 259	194, 177
Italy	22	663	137	5, 072	47	1, 019
Japan	126	3, 948	810	29, 936	632	14, 942
Madagascar	375	38, 688	2, 467	118, 803		
Mexico	5, 506	135, 464	3, 659	131, 832	3, 404	120, 153
Panama	1	217				
Russia in Asia			304	19, 370		
Scotland			(a)	2		
	26, 626	2, 978, 096	21, 095	1, 711, 312	8, 183	452, 076

Country	1922		1923		1924	
	Short tons	Value	Short tons	Value	Short tons	Value
Aden			111	$1, 489		
Austria			59	1, 364	5	$180
Canada	533	$17, 392	893	37, 384	1, 137	58, 628
Ceylon	7, 114	324, 826	7, 244	392, 350	3, 632	171, 804
China					253	3, 905
Chosen			1, 705	24, 262	251	2, 768
Denmark			1	50		
England	144	7, 369	8	1. 400	9	1, 450
France	1, 305	52, 275	843	32, 176	851	57, 009
Germany	6	425	4	389	2	282
Greenland			67	600		
India (British)	102	6, 852	298	23, 059	171	8, 450
Italy	35	1, 045	474	7, 487	155	3, 204
Japan	1, 171	29, 819	2, 106	34, 912	479	8, 362
Madagascar			183	5, 146	429	11, 145
Mexico	2, 196	40, 954	5, 765	41, 339	8, 984	70, 380
Netherlands	(a)	4				
Siam			56	2, 929		
Switzerland					17	1, 944
	12, 606	480, 961	19, 817	606, 336	16, 375	399, 511

[a] Less than 1 ton.

Notwithstanding the decreased production of graphite in 1924, the exports of unmanufactured graphite, which amounted to 21 per cent of the output, increased 13 per cent in quantity and 4 per cent in value compared with 1923. The average value at the port of export declined from 7.63 cents a pound in 1923 to 7.05 cents in 1924. The value of manufactured graphite (exclusive of crucibles) exported decreased 25 per cent.

The exports of lead pencils and pencil leads are not included in the table showing the value of manufactured graphite, nor are exports of crucibles included after 1921. Exports of pencils (other than refillable pencils) and pencil leads in 1924 were 10,623,782 dozen, valued at $1,641,895. The official classification for export statistics contains the group, "Crucibles, clay and graphite," and exports under this heading for 1924 were 548,893 crucibles, valued at $96,001. The corresponding figures for 1923 were 463,265 crucibles, valued at $132,228. No separate figures for exports of graphite crucibles are available.

Graphite exported from the United States, 1919–1924

Year	Unmanufactured graphite		Manufactures of graphite	Year	Unmanufactured graphite		Manufactures of graphite
	Pounds	Value			Pounds	Value	
1919	1,258,040	$90,185	$788,755	1922	1,138,708	$78,094	[a] $255,019
1920	1,213,616	112,771	610,261	1923	1,815,292	138,542	[a] 335,778
1921	1,841,578	95,998	679,359	1924	2,043,411	144,108	[a] 250,957

[a] Exclusive of crucibles, figures for which are not available.

WORLD'S PRODUCTION

The following table, prepared by W. I. Whiteside, shows, as far as figures are available, the production of graphite throughout the world. The most striking features of this table are the continued decrease in production in Austria and the large increase in production in Italy (more than 200 per cent compared with 1923). In Ceylon and Madagascar, the chief sources of supply for this country, the production averaged about the same as in 1923.

World's production of natural graphite, 1920–1924, in metric tons

Country	1920	1921	1922	1923	1924
Africa:					
Kenya Colony	([a])	254	([a])	([a])	([a])
Union of South Africa	66	43	38	54	50
Australia:					
New South Wales	41	----------	51	----------	----------
Western Australia [b]	13	----------	----------	----------	([a])
Austria	11,543	13,280	14,034	9,403	5,820
Canada	1,987	850	590	1,010	([a])
Ceylon [b]	9,353	4,419	11,024	10,840	9,779
Czechoslovakia	22,925	13,522	10,500	9,873	([a])
Chosen [b]	18,228	8,002	19,330	14,776	([a])
Finland	27	----------	----------	----------	----------
France	272	1,100	----------	([a])	([a])
Germany	20,639	24,565	32,342	20,856	([a])
Greenland	[c] 1,380	2,000	432	60	53
India (British)	102	25	20	----------	([a])
Italy	5,398	5,233	4,546	5,691	17,590
Japan	1,133	900	1,046	801	([a])
Madagascar	14,425	6,220	6,675	10,768	11,556
Mexico	2,992	2,911	2,054	5,489	8,023
Norway	10	----------	----------	----------	([a])
Spain	6,315	2,772	530	----------	----------
Sweden	7	----------	----------	----------	([a])
United States:					
Amorphous	4,258	1,671	1,996	3,680	3,693
Crystalline	4,369	540	839	1,798	816

[a] Data not available.

[b] Exports.

[c] Estimated by United States Geological Survey.

FELDSPAR

By Jefferson Middleton

GENERAL CONDITIONS

The feldspar industry in 1924 was exceedingly prosperous on the whole, and made notable progress in output and in the better preparation of material for the market. The quantity and value of crude spar were by far the largest ever recorded. The quantity was 41 per cent greater than that of 1923 and 69 per cent greater than that of 1914. The value was 43 per cent higher than that of 1923 and 140 per cent higher than that of 1914. The greatly increased production of crude feldspar, especially in North Carolina, is explained by the fact that some grinders of feldspar found themselves late in 1923 with low stocks of crude spar which they were unable to replace during the winter. The desire to avoid similar conditions in 1924–25 led to increased production in 1924, hence the mills had large stocks on hand at the close of the year.

Imports of feldspar increased in even greater proportion than did production, but as they constituted less than one-sixth of the total supply in 1924 the domestic industry does not seem to be menaced.

Notwithstanding the large increase in production and imports the sales of ground feldspar increased but little, probably because the pottery industry was not so active in 1924 as in previous years. The sales might have been even smaller but for the glass industry, as manufacturers of bottles and preserving jars are now large users of feldspar.

PRODUCTION

Statistics of production of feldspar are presented separately in tabular form as crude feldspar for mine and quarry output, and as ground feldspar for mill output. The crude feldspar is reported in tons of 2,240 pounds and the ground feldspar in tons of 2,000 pounds, according to the common practice in the industry. The average value of crude feldspar in 1924 at the mine or the shipping point nearest thereto was $7.37 a long ton—8 cents higher than that of 1923. The average value of domestic ground feldspar was 46 cents a short ton higher than in 1923, and that of Canadian spar ground in the United States was $1.04 a ton higher. The average values of crude spar as reported by individual producers ranged from $2 to $16.74 a long ton. For New England the range was from $3.73 to $16.74; for Maryland, New York, Pennsylvania, and Virginia, from $3 to $8.93; for North Carolina, from $2 to $8.86; and for Arizona, California, and Colorado, from $5.60 to $10.08.

CRUDE FELDSPAR

Crude feldspar was reported from 12 States in 1924, an addition of one (South Dakota) to the 1923 list. Notwithstanding the large increase in total output, five States—mostly the smaller producing ones—showed decreased output.

Crude feldspar, produced in the United States, sold in 1917–1924

Year	Long tons	Value	Year	Long tons	Value
1917	126,715	$474,767	1921	91,865	$617,652
1918	88,498	429,989	1922	117,127	844,568
1919	63,441	347,992	1923	145,004	1,057,595
1920	135,551	851,123	1924	204,772	1,509,339

Crude feldspar, produced in the United States and sold in 1923 and 1924, by States

State	1923			1924		
	Long tons	Value [a]		Long tons	Value [a]	
		Total	Average		Total	Average
Arizona	(b)	(b)	$6.00	(b)	(b)	$7.41
California	9,297	$62,499	6.72	8,027	$62,344	7.77
Colorado	(b)	(b)	5.00	(b)	(b)	5.60
Connecticut	8,780	75,379	8.59	6,572	51,422	7.82
Maine	25,029	230,122	9.19	29,912	271,354	9.07
Maryland	2,750	17,010	6.19	4,854	25,020	5.15
New Hampshire	23,220	171,789	7.40	39,425	324,638	8.23
New York	15,161	127,477	8.41	13,839	108,751	7.86
North Carolina	57,622	360,636	6.26	97,075	640,403	6.60
Pennsylvania	2,069	6,355	3.07	1,481	4,763	3.22
South Dakota	---------	---------	---------	(b)	(b)	4.48
Virginia	(b)	(b)	6.26	(b)	(b)	6.00
Undistributed	1,076	6,328	---------	3,587	20,644	---------
	145,004	1,057,595	7.29	204,772	1,509,339	7.37

[a] Value at mine or nearest shipping point.
[b] Included under "Undistributed."

GROUND FELDSPAR

Probably all the feldspar consumed industrially, except that used for facing cement work, for covering prepared roofing, for "chicken grits," and like purposes, is prepared by fine grinding. Even for such uses the spar is at least crushed to small sizes and more or less graded by screening, but it has not been possible to canvass all users of feldspar to determine the amounts ground and used by them. All known merchant mills or grinders—that is, those who quarry or purchase crude spar and grind it for sale to other establishments—have been canvassed for statistics of ground feldspar during the last 3 years.

For 1924, 30 mills in 13 States reported 189,780 short tons of ground feldspar, an increase of 4 mills and 2 States (Illinois and North Carolina) compared with 1923. Of these mills 26 worked on domestic spar and 6 on Canadian spar, 2 mills grinding both domestic and Canadian spar. Of the total quantity 86 per cent (163,905 tons) was domestic spar, and 14 per cent (25,875 tons) was Canadian spar—the same percentages as for 1923. The average value per ton of all ground domestic feldspar f. o. b. mills in 1924 was $16.84, an increase of 46 cents compared with 1923; and of Canadian spar $20.21, an increase of $1.04 compared with 1923. Direct comparison of values is misleading, however, as the figures for Canadian spar generally relate to high-grade material at mills near points of consumption, whereas the figures for domestic spar cover all grades at various points, some of which are distant from consuming centers. The average value of domestic spar ground in Ohio was $19.26; in New Jersey, $21.08; and in Tennessee, $13.28. Values reported by producers in New Jersey and Ohio ranged from $14.50 to $22.42; in New England, from $14.15 to $20; in North Carolina and Tennessee, from $11.13 to $16; and in California, from $20.13 to $22.36.

Three new mills for grinding feldspar were established during 1924, two in California and one in Illinois. The Kingman Feldspar Co., Kingman, Ariz., is also equipped for grinding spar but did not report any ground spar for 1924.

Ground feldspar sold by merchant mills[a] in the United States, 1922–1924

Year	Number of operators	Domestic			Canadian			Total		
		Short tons	Value		Short tons	Value		Short tons	Value	
			Total	Average		Total	Average		Total	Average
1922	20	107,969	$1,790,305	$16.58	19,075	$364,082	$19.09	127,044	$2,154,387	$16.96
1923	26	151,855	2,486,810	16.38	25,374	486,546	19.17	177,229	2,973,356	16.78
1924	30	163,905	2,760,286	16.84	25,875	522,884	20.21	189,780	3,283,170	17.30

[a] Does not include potters and others who grind for consumption in their own plants.

Ground feldspar sold by merchant mills[a] in the United States in 1924

State	Number of operators	Domestic		Canadian	
		Short tons	Value	Short tons	Value
California	3	2,180	$46,387		
Connecticut	3	2,741	46,927		
Maine	3	24,411	465,107		
New Jersey	3	30,602	645,108		
New York	4	([b])	([b])	22,150	$445,757
Ohio	4	([b])	([b])	3,725	77,127
Tennessee	4	52,571	697,962		
Undistributed[c]	6	51,400	858,795		
	30	163,905	2,760,286	25,875	522,884

[a] Does not include potters or others who grind for consumption in their own plants.

[b] Included under "Undistributed."

[c] Includes Delaware, Illinois, Maryland, New Hampshire, New York, North Carolina, Ohio, and Pennsylvania.

THE INDUSTRY BY STATES

The production of crude feldspar in 1924 was reported from 12 States, which were, in the order of their output, North Carolina, New Hampshire, Maine, New York, California, Connecticut, Maryland, South Dakota, Pennsylvania, Arizona, Virginia, and Colorado.

This relative order is practically the same as that of 1923, the exceptions being the advance of New Hampshire to second place and the appearance of South Dakota as a producer. Feldspar was ground by merchant mills in each of these States except Arizona, Colorado, South Dakota, and Virginia. In addition, mills were operated in Delaware, Illinois, New Jersey, Ohio, and Tennessee.

Arizona.—The deposit of feldspar near Kingman, Mohave County, was operated by G. I. Taylor early in the year. He was, however, succeeded by the Kingman Feldspar Co. in March, 1924. The material from this deposit finds its market in the California ceramic industries.

California.—Seven operators in Riverside and San Diego Counties reported the production of crude feldspar in 1924. The quantity and value showed small decreases compared with 1923. Most of the spar was sold crude. Two new grinding mills were established in this State, and the quantity and value of ground spar increased considerably.

Colorado.—Colorado has been an intermittent producer of feldspar in small lots. For 1924 production was reported by one operator in Jefferson County. The material was used in the ceramic industry.

Connecticut.—Ten operators in Connecticut reported sales of crude feldspar in 1924, an increase of two compared with 1923. The output, however, decreased 25 per cent in quantity and 32 per cent in value. The chief producers, Louis W. Howe, Eureka Flint & Spar Co., and Golding Sons Co., reported nearly three-fourths of the output. The product of the Howe quarry was ground in a mill operated by Mr. Howe. The greater part of the output of other quarries was shipped to mills in East Liverpool, Ohio, and Trenton, N. J., where it was ground for use in the ceramic industries.

Delaware.—The only feldspar mill in Delaware in 1924 was that of the Golding Sons Co., at Wilmington. This mill was destroyed by fire in 1924 and will not be rebuilt.

Illinois.—A mill operated by the Isco-Bautz Co. (Inc.) was established at Murphysboro in 1924 for grinding feldspar from South Dakota.

Maine.—In 1924 Maine ranked third among the States in output of crude feldspar and showed an increase of 20 per cent in quantity and 18 per cent in value compared with 1923. Fifteen operators in Androscoggin, Cumberland, Lincoln, Oxford, and Sagadahoc Counties, an increase of seven operators compared with 1923, reported the output. The largest quantity was produced by the Maine Feldspar Co., which is also the largest producer of ground spar in the State. Maine also ranked third in the quantity of domestic ground feldspar sold in 1924.

Maryland.—The production of crude feldspar in Maryland in 1924 showed an increase of 77 per cent in quantity and 47 per cent in value compared with 1923. This material was produced by a comparatively large number of small operators who sell to the only mill in the State—the Seaboard Feldspar Co., of Baltimore, which succeeded the Product Operating Co. during 1924.

New Hampshire.—New Hampshire was the second largest producer of crude feldspar in 1924, displacing Maine, and showed the second largest actual increase in quantity and value—16,205 tons, or 70 per cent, and $152,849, or 89 per cent, compared with 1923. The Golding-

Keene Co. and the Standard Feldspar Co. were the largest producers. The latter was organized in 1924 by the consolidation of three other companies. New Hampshire's product was used in the ceramic and soap industries. The Golding-Keene Co. was the only operator of a mill in the State and ground mainly its own crude material.

New Jersey.—New Jersey's connection with the feldspar industry is through its mills, as it is not a feldspar-producing State. At Trenton are the mills of the Eureka Flint & Spar Co., the Golding Sons Co., and the Trenton Flint & Spar Co. These mills reported nearly one-fifth of the domestic ground spar sold in 1924. Trenton is therefore both one of the principal feldspar markets and one of the principal centers of feldspar consumption by reason of its very large pottery industry and the large capacity of the mills.

New York.—This State ranks fourth in the quantity of crude feldspar produced and fifth in the production of ground spar from domestic material. It is the larger grinder of spar from Canada and ranks second in the total production of ground spar. Its crude spar is produced in Essex, St. Lawrence, and Westchester Counties by the Adirondack Spar Mining Co., the Green Hill Mining Co., and the Bedford Mining Co., respectively. There were four mills in the State for grinding feldspar—that of the Bedford Mining Co., at Bedford, for domestic spar; those of the Dominion Feldspar Corporation and the Genesee Feldspar Co. (Inc.), at Rochester, for Canadian spar; and that of the New York Feldspar Corporation, at Rochester, for domestic and Canadian spar.

North Carolina.—This State was the largest producer of feldspar in 1924, as it has been for several years. Its output showed an increase of 39,453 tons, or 68 per cent, and $279,267, or 78 per cent, compared with 1923. North Carolina's output constituted 47 per cent of the total quantity and 42 per cent of the total value for 1924. This output was made by numerous small operators who sell or barter the spar to some central distributing agency. Some of the larger buyers and distributors are the Erwin Feldspar Co. (Inc.), Clinchfield Products Corporation, Carolina Mineral Co., and J. C. Pitman. Most of the spar was produced in Mitchell and Yancey Counties along the line of the Clinchfield Railroad Co. Developments in Avery County during 1924 indicate that this county will also be an important producer of feldspar. The mill of the North State Feldspar Corporation, at Micaville, was the only one in operation in the State in 1924.

Ohio.—No feldspar is produced in Ohio, but as this State and adjacent territory in Pennsylvania and West Virginia produce more than one-half of the high-grade pottery made in the United States, the region is a large consumer of feldspar. The potteries are partly supplied by the mills within the State operated by the Cleveland Feldspar & Products Co., at Cleveland; the Golding Sons Co. and the Potters Mining & Milling Co., at East Liverpool; and the Rock Products Co., at Silica, near Toledo. The Golding Sons Co. ground only domestic spar in 1924, the Potters Mining & Milling Co. and Rock Products Co. ground only Canadian spar, and the Cleveland Feldspar & Products Co. ground both domestic and foreign spar.

Pennsylvania.—Three operators reported the production of feldspar in Pennsylvania in 1924, but two of the operations were very small. The American Feldspar Co. operated the only mill in the State, at Toughkenamon.

Tennessee.—The feldspar industry in Tennessee is represented only by grinding mills, of which four were in operation in 1924. The mills of the Clinchfield Products Corporation, Erwin Feldspar Co. (Inc.), and Golding Sons Co. are at Erwin, and that of the Tennessee Mineral Products Co. is at Bristol. The Willms Co. was succeeded during the summer of 1924 by the Golding Sons Co. Tennessee is the leading feldspar-grinding State; nearly one-third of the total output of domestic ground spar was produced there in 1924.

Virginia.—In 1924 sales were made from two feldspar quarries in Virginia—from that of the Moneta Mineral & Mining Co., at Moneta, Bedford County, and that of the Vicama Mica Co., at Axton, Henry County. The former has gone out of business and the quarry is now being operated by or for the Seaboard Feldspar Co., of Baltimore; the latter has been abandoned.

IMPORTS

The foreign trade of the United States in feldspar is small and limited largely to imports from Canada. Before the tariff act of 1922 imports of feldspar were not specifically classified in the official records and are therefore unknown. The following table, taken from records of the Bureau of Foreign and Domestic Commerce, shows the imports since then.

Crude feldspar imported for consumption in the United States, 1922–1924

Year	Long tons	Value	
		Total	Average
1922 (Sept. 22–Dec. 31)	7,549	$60,111	$7.96
1923	24,271	184,924	7.62
1924	35,139	284,716	8.10

FOREIGN PRODUCTION

A considerable part of the supply of feldspar annually available for the ceramic and other feldspar-consuming industries in the United States is mined in Canada. According to reports of the Dominion Bureau of Statistics the Canadian shipments—all from Ontario and Quebec—amounted in 1924 to 38,411 short tons, valued at $299,174, or $7.79 a ton, an increase of 31 per cent in quantity and 26 per cent in value compared with 1923. Of the total quantity 37,869 tons (99 per cent) was exported, most of it to the United States. The sales of Canadian spar ground in the United States in 1924 constituted 14 per cent of all ground spar sold in this country in that year, which was the same percentage as in 1923.

Feldspar, produced in Canada, sold in 1917–1924

Year	Short tons	Value	Year	Short tons	Value
1917	19, 462	$89, 826	1921	29, 868	$230, 754
1918	18, 782	112, 728	1922	27, 727	248, 402
1919	14, 679	86, 231	1923	29, 225	237, 601
1920	37, 873	280, 895	1924	38, 411	299, 174

The following table, prepared by Miss W. I. Whiteside, of the Bureau of Mines, shows the most recent figures for the production of feldspar in foreign countries. Besides the United States and Canada, Sweden, Norway, and Germany are the chief producing countries. Although the United Kingdom has an immense pottery industry, it appears to be a small producer of feldspar. Cornwall stone rather than feldspar is extensively used as a flux in the British pottery industry.

Feldspar output of principal producing countries, 1920–1924, in metric tons

Country	1920	1921	1922	1923	1924
Australia:					
New South Wales	----------	25	25	13	15
South Australia	4	----------	----------	20	([a])
Western Australia (exports)	----------	1	61	----------	([a])
Canada	34, 358	27, 096	25, 153	26, 512	34, 846
Finland	55	957	1, 322	([a])	([a])
France	4, 400	4, 625	2, 000	([a])	([a])
Germany (Bavaria)	5, 850	7, 249	6, 080	8, 996	([a])
Italy	2, 600	2, 460	2, 790	5, 070	([a])
Japan	([a])	([a])	16, 051	([a])	([a])
Norway	6, 397	9, 348	11, 833	13, 073	([a])
Russia	426	673	685	([a])	([a])
Sweden	12, 049	20, 169	22, 371	16, 857	([a])
United Kingdom	3, 419	1, 107	843	3, 298	([a])
United States	137, 727	93, 339	119, 007	147, 331	208, 059

[a] Data not available.

POTASH[1]

By GEORGE ROGERS MANSFIELD and LEONA BOARDMAN

INTRODUCTION

The year 1924 was marked by continued low-price levels for foreign potash and was particularly noteworthy because of the signing in August of the Franco-German potash agreement, which virtually reestablished the German-Alsatian potash monopoly. The American industry, however, not only held the place it had gained during the previous year but made substantial gains. This was largely due to the work of the American Trona Corporation, which was the principal producer.

The number of plants reporting potash production in the United States was 11, one less than in 1922 and 1923.

Interest in the Texas potash field was sustained, as a larger number of wells in an increasing number of counties furnished data on potash resources. Among these wells was one in a salt dome in Matagorda County, which furnished the first evidence of potash in connection with such a structural feature in the United States. An interesting find was also reported from Grand County, Utah, and an increasing interest developed in the brines of the Salduro Marsh, in northwestern Utah. More detailed statements regarding these developments are given on pages 45–46.

PRODUCTION AND SALES

The production and sales of potash in the United States in 1924 are summarized in the following table with as much detail as is possible without revealing individual reports that must be considered confidential.

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[1] Since 1910 a chapter on potash has appeared annually in Mineral Resources. Extensive bibliographies and lists of United States patents that cover processes for the extraction of potash from silicate rocks have been included in most of these chapters. The chapter for 1910 contained a brief account of the German potash deposits, the chapter for 1915 gave simple tests for potash, those for 1916 and 1917 included descriptions of the sources of potash in this country and brief statements concerning efforts to produce potash from other sources, and the chapter for 1918 included descriptions of refined potassium salts.

Potash produced, sold, and in stock in the United States in 1924, by sources

	Organic		Mineral [a] (natural brines, dust from cement mills and blast furnaces)	Total
	Molasses distillery waste	Steffens water from beet-sugar refineries		
Production:				
Number of plants reporting	1	1	9	11
Crude potash ... short tons	10,302	600	32,817	43,719
Available content of K_2O:				
Short tons	3,430	72	19,394	22,896
Percentage of total	15	----------	85	100
Sales:				
Number of plants reporting	1	1	7	9
Crude potash ... short tons	947	600	35,945	37,492
Available content of K_2O ... do	315	72	21,493	21,880
Value f. o. b. plant	$19,055	$4,800	$818,763	$842,618
Stocks on hand Dec. 31, 1924:				
Number of plants reporting	1	----------	9	10
Crude potash ... short tons	27,749	----------	4,596	32,345
Available content of K_2O ... do	9,238	----------	1,507	10,745

[a] Of the plants reporting on potash from mineral sources two obtained it from natural brines and the rest from cement-mill or blast-furnace dust.

The production in 1924 shows an increase of 12 per cent in crude potash and of 13 per cent in the available potash (K_2O) content. The average percentage of available potash was 52.4, as compared with 51.8 per cent in 1923.

The sales of crude potash were 7 per cent greater and the available potash content of the material sold 13 per cent greater than in 1923. The total value of the potash sold in 1924 was 7 per cent more than in 1923, but the value per unit (20 pounds of K_2O) was only 39 cents, as compared with 41 cents in 1923.

Potash produced and sold in the United States, 1916–1924

Year	Number of plants		Production		Sales [a]		
	Total	Exclusive of producers of wood-ash potash	Crude potash (short tons)	Available content of K_2O (short tons)	Crude potash (short tons)	Available content of K_2O (short tons)	Value f. o. b. plant
1916	70	25	35,739	9,720	35,739	9,720	$4,242,730
1917	95	46	126,961	32,573	126,961	32,573	13,980,577
1918	128	77	207,686	54,803	140,343	38,580	15,839,618
1919	102	67	116,634	32,474	166,063	45,728	11,271,269
1920	66	49	166,834	48,077	139,963	41,444	7,463,026
1921	20	19	25,485	10,171	10,337	4,408	447,859
1922	12	12	25,176	11,714	22,028	11,313	463,512
1923	12	12	39,029	20,215	35,164	19,281	784,671
1924	11	11	43,719	22,896	37,492	21,880	842,618

[a] Production and sales were practically the same in 1916 and 1917, and no distinction was made between them.

A comparison of the figures for 1924 with those for 1918, when domestic production was at its height, shows that in 1918 the crude-potash production was over four and one-half times as great as in 1924, whereas the available potash (K_2O) content of the material produced in that year was only about two and one-half times that for 1924.

Potash produced in the United States in 1924, by States

State	Number of plants	Crude potash (short tons)	Available content of K_2O	
			Short tons	Percentage of total
California	3	32,121	19,361	84.6
Maryland	1	10,302	3,430	15.0
Indiana	1	1,296	105	.4
Pennsylvania	6			
	11	43,719	22,896	100.0

In only two States was potash produced in 1924 in more than two plants. California was still by far the largest producer, as in 1923. The greatest increase in production was made in Maryland. The figures for Indiana and Pennsylvania are combined in order to avoid revealing confidential information.

Domestic potash sold in the United States, 1923–24

Material sold	Crude potash (short tons)	Available content of K_2O		
		Per cent	Short tons	Percentage of total
1923				
Chloride	30,079	44–59	17,734	92.0
Dust from cement mills and blast furnaces	4,036	0.75–33	1,285	6.6
Mixed salts	1,000	25	250	1.3
Sulphate [a]	44	25	11	.1
Carbonate	5	30	1	
	35,164	------------	19,281	100.0
1924				
Chloride	34,187	46–61	20,935	95.7
Dust from cement mills and blast furnaces (mostly sulphate)	1,758	0.75–33	558	2.6
Mixed salts	947	33	315	1.4
Carbonate	600	12	72	.3
	37,492	------------	21,880	100.0

[a] Exclusive of sulphate produced from dust from cement mills and blast furnaces.

The material sold in 1924, as in 1923, consisted chiefly of chloride. The dust from cement mills and blast furnaces was largely sold in the form of sulphate with a little muriate.

IMPORTS [2]

The imports of potash materials are shown in the following tables. The materials are classified into salts used chiefly in the fertilizer industry and those used chiefly in the chemical industries. The former class, which includes kainite, manure salts, muriate, and sulphate, constituted 93.4 per cent of the total imports.

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[2] Figures relating to imports and exports obtained from the Bureau of Foreign and Domestic Commerce.

Potash materials imported for consumption in the United States, 1913, 1923, and 1924 [a]

Material	Approximate K_2O content (per cent)	1913				1923				1924			
		Short tons	Available content of K_2O		Value	Short tons	Available content of K_2O		Value	Short tons	Available content of K_2O		Value
			Short tons	Percentage of total			Short tons	Percentage of total			Short tons	Percentage of total	
Used chiefly in fertilizers:													
Kainite	12.4	521,176	64,626	23.7	$2,201,730	187,833	23,291	11.1	$977,807	175,513	21,764	10.9	$923,740
Manure salts	20.0	250,529	50,106	18.4	2,245,509	301,721	60,344	28.8	2,939,793	258,998	51,800	25.8	2,278,484
Muriate	50.0	237,630	118,815	43.6	7,075,745	151,757	75,879	36.1	4,116,180	144,623	72,312	36.1	3,982,288
Sulphate	48.6	44,349	21,554	7.9	1,677,429	71,390	34,696	16.5	2,599,695	84,780	41,203	20.6	2,858,063
		1,053,684	255,101	93.6	13,200,413	712,701	194,210	92.5	10,633,475	663,914	187,079	93.4	10,042,575
Used chiefly in chemical industries:													
Bicarbonate	46.0	223	103	--------	20,968	161	74	--------	19,954	185	85	.1	25,754
Bitartrate (argol)	20.0	14,499	2,900	1.1	2,779,180	9,832	1,966	.9	1,499,389	8,416	1,683	.8	1,103,296
Bitartrate (cream of tartar)	25.0	75	19	--------	28,314	640	160	.1	194,084	766	192	.1	165,421
Bromide	39.6	--------	--------	--------	--------	26	10	--------	5,736	468	185	.1	124,414
Carbonate, crude	61.0	4,858	2,963	1.1	272,973	4,906	2,993	1.4	518,632	3,569	2,177	1.1	290,396
Carbonate, crude or black salts	50.0	344	172	.1	17,852								
Carbonate, refined	67.0	6,145	4,117	1.5	393,284								
Caustic	80.0	4,324	3,459	1.3	342,056	5,419	4,335	2.1	685,309	6,315	5,052	2.5	698,635
Chlorate and perchlorate	38.0	596	226	.1	64,468	6,749	2,565	1.2	569,399	3,760	1,429	.7	310,643
Chromate and bichromate	40.0	9	4	--------	1,819	3	1	--------	1,033	5	2	--------	1,924
Cyanide	70.0	735	514	.2	216,844	983	688	.3	161,825	1,411	988	.5	232,971
Ferricyanide (red prussiate)	42.0	34	14	--------	12,035	56	24	--------	66,909	41	17	--------	25,308
Ferrocyanide (yellow prussiate)	44.0	1,706	751	.3	388,379	188	83	.1	82,263	132	58	--------	40,032
Iodide	28.0	--------	--------	--------	--------	(b)	(b)	--------	140	(b)	(b)	--------	210
Nitrate (saltpeter), crude	40.0	4,826	1,930	.7	261,078	3,077	1,231	.6	137,228	772	309	.2	54,628
Nitrate (saltpeter), refined	46.0	203	93	--------	22,602	2,962	1,363	.7	634,921	2,279	1,048	.5	209,805
Permanganate	29.0	273	79	--------	38,188	561	163	.1	142,887	87	25	--------	18,940
Rochelle salt	22.0	54	12	--------	13,412	164	36	--------	40,917	104	23	--------	24,003
All other	50.0	--------	--------	--------	--------	97	48	--------	10,471	26	13	--------	4,172
		38,904	17,356	6.4	4,873,452	35,824	15,740	7.5	4,771,097	28,336	13,286	6.6	3,325,552
Grand total	--------	1,092,588	272,457	100.0	18,073,865	748,525	209,950	100.0	15,404,572	692,250	200,365	100.0	13,368,127

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[a] The figures in this table were compiled by J. A. Dorsey from the records of the Bureau of Foreign and Domestic Commerce by recalculation from pounds to short tons and to actual potash (K_2O) and by giving the totals for calendar years instead of fiscal years. The tons are calculated to the nearest even unit, and the values are those given in the original records, so that the value given for a high-priced commodity received in small quantity may not be strictly applicable to the quantity given in tons Furthermore, the values are those placed on the commodities by the shippers and represent the values at point of shipment and do not agree with the market quotations in this country.

[b] Quantity of iodide imported was as follows: 1923, 24 pounds; 1924, 47 pounds.

In 1913, the last normal year before the war, the United States imported 272, 457 short tons of K_2O. In 1924 the total imports were 200,365 tons, or 74 per cent of that amount. This was 9,585 tons, or 4.6 per cent, less than the imports in 1923, but practically the same as the imports in 1922.

Potash (K_2O) imported for consumption in the United States, 1913–1924, in short tons

1913	272, 457	1917	8, 100	1921	78, 698
1914	207, 089	1918	7, 957	1922	201, 415
1915	48, 867	1919	39, 619	1923	209, 950
1916	7, 885	1920	224, 792	1924	200, 365

The following table indicates the amount of potash imported in 1924 from each country. Germany and France supplied direct, respectively, 57 and 37 per cent of the total imports of crude potash and 62 and 31 per cent of the K_2O.

Potash imported into the United States in 1924, in short tons [a]

[General imports. The figures in parentheses in the column headings indicate percentage of K_2O]

Country	Muriate (50)	Sulphate (48.6)	Manure salts (20)	Kainite (12.4)	Bitartrate argols or wine lees (20)	Bitartrate cream of tartar (25)	Caustic (80)	Carbonate (61)	Cyanide (70)	Nitrate of, or saltpeter, crude (40)	Chlorate and perchlorate (36)	All other (50)	Total	
													Short tons	Value
Africa:														
Algeria and Tunis					238								238	$31,221
Other French Africa						37							37	3,910
Argentina	330	39			1,309	86							1,764	145,317
Austria												2	2	1,400
Belgium	7,955	3,984	13,053	5,356					4		35	242	30,629	619,514
Canada	1,624	36	750		12	(^{b})	(^{b})		1,326			5	3,753	251,485
Chile					60					482			542	28,965
Czechoslovakia							399	3				1	403	46,342
Denmark												9	9	2,616
England								2				82	84	33,011
France	53,485	6,337	94,480	91,086	3,835	392				21	136	50	249,822	3,617,959
Germany	80,425	74,340	144,464	77,106	53	26	5,825	3,106	129	184	2,869	2,354	390,881	7,760,564
Greece					2								2	263
Hongkong	(^{b})	(^{b})	(^{b})					(^{b})					(^{b})	393
India, British					37					84			121	20,817
Ireland						1							1	379
Italy					1,462	25						2	1,489	230,472
Japan					(^{b})								(^{b})	36
Netherlands	440				11	158	37	28		1	22	414	1,111	127,543
Portugal					533								533	63,429
Scotland			114										114	2,476
Spain			420		820	38							1,278	115,431
Sweden							68						68	25,351
Switzerland											682	9	691	79,654
	144,259	84,736	253,281	173,548	8,372	763	6,329	3,139	1,459	772	3,744	3,170	683,572	13,208,548
Content of potash (K_2O)	72,130	41,182	50,656	21,520	1,674	191	5,063	1,915	1,021	309	1,348	1,585	198,594	

[a] The figures in this table were compiled by J. A. Dorsey from the records of the Bureau of Foreign and Domestic Commerce by recalculation to short tons and to the actual potash (K_2O) and by giving the totals by the calendar year instead of the fiscal year. The tons are calculated to the nearest even unit. The data represent general imports and include both imports for immediate consumption and those going to warehouses, which may or may not be entered for consumption during the year. They differ slightly from the figures in the preceding table of imports, which represents imports for consumption.

[b] Less than 1 ton.

EXPORTS

Some potash materials in the form of refined potassium salts are exported from the United States. In 1924 the value of the salts exported was only 60 per cent of the corresponding value in 1923.

Potassium salts exported from the United States, 1923–24

Salt	1923			1924		
	Gross weight (short tons)	K_2O (short tons)	Value	Gross weight (short tons)	K_2O (short tons)	Value
Potassium bichromate	1,631	522	$295,751	585	187	$100,017
Potassium chlorate	100	38	21,995	281	107	31,577
All other potassium salts	2,266	997	188,091	1,057	465	169,442
	3,997	1,557	505,837	1,923	759	301,036

CONSUMPTION OF POTASH IN THE UNITED STATES

The consumption of potash in the United States in 1924, as measured by the quantity imported and the quantity sold here, was 729,742 short tons of crude material, containing 222,245 short tons of K_2O, valued at $14, 210, 745. This was a decrease of 3 per cent in quantity of K_2O and of 12 per cent in value as compared with 1923. Of the quantity consumed 5 per cent of the crude material, containing 10 per cent of the K_2O and representing 6 per cent of the total value, was produced in this country. About 94 per cent of this supply was used in the manufacture of fertilizers.

MARKET CONDITIONS

The market conditions affecting potash in 1924 were little changed from those of the preceding year. As cotton and tobacco are the chief potash-consuming crops, the States east of Mississippi River and south of Ohio River and the Mason and Dixon line are the chief users of potash, although in the Northeastern States some potash is applied to potatoes and truck-farm products. On the basis of K_2O, 90.2 per cent of the potash consumed in the United States in 1924 was imported. Germany and France supplied most of the imported material (see p. 32), but small amounts came from other countries. The low prices at which foreign potash has been available have continued to curb American production and particularly to discourage the launching of new enterprises.

PRICES

Prices of potash in the United States in 1924 were virtually controlled by quotations on imported potash made by the Potash Importing Corporation of America and the United States bureau of the Société Commerciale des Potasses d'Alsace, representing respectively the German and French potash-producing interests. The range in price was $31.09½ to $34.55 a ton for 80 per cent muriate and $41.26½ to $45.85 a ton for 90 per cent sulphate.[3]

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[3] Oil, Paint, and Drug Reporter, Mar. 26, 1925, p. 94.

The higher figures given above, announced under the new agreement between French and German producers, are those for the last quarter of the year and the early part of 1925 for material in bags. The corresponding prices per ton for other grades of salts were as follows:

Sulphate of potash, magnesia, or double manure salts, 48 per cent, in bags		$26.35
Manure salts, 30 per cent	in bags	19.03
	in bulk	17.03
Manure salts, 20 per cent	in bags	12.55
	in bulk	10.55
Kainite, 14 per cent	in bags	10.25
	in bulk	8.25
Kainite, 12.4 per cent	in bags	9.75
	in bulk	7.75

All quotations were made c. i. f. eastern United States ports.

Discounts ranged from 5 per cent on purchases of 50 tons of pure potash (K_2O) to 10 per cent on purchases of 500 tons. The previous schedule did not differ greatly in prices quoted, but it did not offer the 10 per cent discount to buyers of less than 10,000 tons of pure potash. This feature was favorable for the small or moderate buyers and tended to greatly reduce the resales. When the new schedule was announced an additional rebate of 5 per cent was offered to buyers who placed their orders in the hands of the importing company before October 1, when the schedule was to go into effect.

In the spring of 1925 the two importing organizations issued a price list of potash salts for shipment from Europe between May 1 and September 30, 1925. The prices were quoted per ton of 2,000 pounds net weight, c. i. f. Atlantic and Gulf ports.[4] All the salts are sold on foreign weights, tares, and analyses. Discounts similar to those above cited but graded according to quantity ordered and rebates graded from 6 to 2 per cent according to date of order are offered. Prices are subject to change on notice but are guaranteed until April 30, 1926. The prices of goods in bags are the same as those cited above except that 30 per cent manure salts are cited at $19.50 instead of $19.03, and 20 per cent manure salts, at $13 instead of $12.55. The bulk prices are as follows: Muriate, 80 per cent KCl, $33.30; sulphate, 90 per cent, K_2SO_4, $44.60; manure salts, 30 per cent K_2O, $17.50; manure salts, 20 per cent K_2O, $11; kainite, prices unchanged.

GERMAN-ALSATIAN POTASH AGREEMENT

The outstanding feature of the year affecting the potash situation both in Europe and in America was the signing on August 14 of an agreement made retroactively effective from May 1, 1924, between the German potash syndicate and the Société Commerciale des Potasses d'Alsace, establishing a basis of cooperation between the two organizations in sales of potash to consumers in the United States. According to a consular report[5] this agreement, which virtually reestablished the German-Alsatian potash world monopoly, is to continue three years.

> Of the total sales of pure potash to that country [the United States] the German potash mines are to enjoy 62½ per cent and the Alsatian 37½ per cent. However, the German percentage increases to 68.8 owing to the preference of sulphates.

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[4] American Fertilizer, Apr. 18, 1925, p. 29; May 2, 1925, p. 29.

[5] Ravndal, C. M. (United States consul in charge, Frankfort-on-the-Main), report dated Aug. 27, 1924.

It was estimated, on the basis of sulphate sales to the United States in 1923, that Germany will deliver 35,000 metric tons and Alsace 5,000. In the same manner, with a total sale of 200,000 metric tons of pure potash, the quota will be 131,500 metric tons and 68,500 metric tons, respectively. Any deliveries in excess of this will be made in the above proportion. If either of the contracting parties should fail to deliver its full quota, the other party will take over the remaining sales after conceding 15 per cent.

It is officially announced[6] that an agreement holding out the prospect of a lasting fusion of interests has been concluded between the Alsace potash mines and the German Kalisyndikat for the marketing abroad of their respective outputs. The terms of the agreement are not disclosed, but it is reported that whereas the previous arrangement was limited to the American and Swedish markets, the new agreement applies to every country. There are no quotas fixed in advance, but the shipments of the two contracting parties are based on the consumptive capacity of the several countries and the orders they have placed hitherto. It is stated further that, instead of seeking to maintain prices at the present level, the contracting parties will endeavor to reduce them by developing existing markets and finding new ones, especially in countries in which artificial fertilizers are most in favor.

LOCAL AGREEMENT

According to advices from Baltimore[7] the Associated Fertilizer Manufacturers of America at a meeting held in that city decided to contract with the Société Commerciale des Potasses d'Alsace, the French potash syndicate, for about 75 per cent of their requirements in potash. The remainder is to be purchased direct from the U. S. Industrial Chemical Co., of Baltimore, which produces potash as a by-product from molasses distillery waste.

AMERICAN POTASH INDUSTRY

As shown on page 27, the number of producing plants in 1924 was one less than in 1923, though the pure potash (K_2O) content of the product was greater and there was a slight improvement in the average quality of the product. Of the operating plants all but one produced potash as a by-product, and at that one, the plant of the American Trona Corporation, a valuable by-product, borax, was obtained. Six of the plants were blast furnaces in which potash was recovered from flue dusts and sold chiefly in the form of sulphate. Two plants obtained potash from natural brines; in 1923 there were three such plants. Of the other plants one made mixed potash salts from molasses distillery waste; one made a carbonate solution from Steffens (beet sugar) waste water; and one made a sulphate from cement dust. The names and locations of the producing plants were as follows:

Blast furnaces:
- Carnegie Steel Co., Lucy Furnaces, Pittsburgh, Pa.
- Carnegie Steel Co., Isabella Furnaces, Etna, Pa.
- Carnegie Steel Co., Neville Furnace, Pittock, Pa.
- Lavino Furnace Co., Sheridan, Pa.
- Lavino Furnace Co., Marietta, Pa.
- Lavino Furnace Co., Lebanon, Pa.

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[6] Min. Jour. (London), May 16, 1925, p. 396.
[7] Commercial Fertilizer, vol. 29, No. 4, p. 54, November, 1924.

Salines:
  American Trona Corporation, Searles Lake, Calif.
  Whitney Chemical Co., Leslie (San Mateo post office), Calif.
Molasses distillery waste:
  U. S. Industrial Chemical Co., South Baltimore, Md.
Steffens waste water:
  Holland-St. Louis Sugar Co., Decatur, Ind.
Cement dust:
  Santa Cruz Portland Cement Co., Davenport, Calif.

The American Trona Corporation, the principal producer, made increases of 11.5 and 10 per cent, respectively, in the output of its chief products, potash and borax. There was also a noteworthy improvement in the quality of its potash, which was already exceptionally high. Practically all of the output and of the accumulated stock was sold, comparatively little stock being left on hand at the end of the year.

The other producing companies, which made lower-grade material at higher costs, sold what they could of their product at rates per unit of K_2O ranging from 1.5 to 5.4 times as much as the rate charged by the American Trona Corporation, which in turn was somewhat higher than the rate for imported 80 per cent muriate. Naturally sales at the higher prices were small, and most of the companies accumulated stocks in considerable excess over those of the preceding year. Nevertheless, because of the activities of the American Trona Corporation the total stocks reported at the end of 1924 were less than those for 1923 by 2,449 short tons of crude material, or 1,618 tons of K_2O, reductions of 7 and 13 per cent, respectively.

OTHER OPERATIONS

CALIFORNIA

Burnham Chemical Co.—The Burnham Chemical Co., with office at 212 Nevada State Life Building, Reno, Nev., and plant at Searles Lake, Calif., reports no production of potash in 1924 but says that it completed its borax unit. Much of the energy of the company seems to have been devoted to selling stock. In view of the market conditions affecting potash and of the uncertainties regarding markets for other salts that the company plans to produce, the whole project must still be considered as in the highest degree speculative.[8]

California Kelp Co.[9]—The California Kelp Co., with offices in the Exchange Building, Los Angeles, has been organized under the laws of California with a capitalization of $1,000,000 for the purpose of manufacturing potash, iodine, decolorizing carbons, and ammonium sulphates, as well as organic distillates. It has taken a lease for 20 years on a factory site at National City, on San Diego Bay, where it will erect a plant with a daily capacity of 200 tons to treat kelp for the manufacture of the chemicals named. The officers are Andrew Brown, president; Carl Schultz, vice-president; Dan W. Knoll, secretary and treasurer; and these men with Thomas Humphreys and James A. Bovee, board of directors.

Inyo Chemical Co.—In addition to its holdings at Deep Springs Valley the Inyo Chemical Co. has acquired rights in a plant at

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[8] For editorial comment on the activities of the Burnham Chemical Co. see Chemical and Metallurgical Engineering, Aug. 8, 1924, pp. 295-297; Sept. 15, p. 436; Nov. 24, pp. 804, 805.

[9] Am. Fertilizer, vol. 61, No. 4, p. 27, Aug. 23, 1924; Commercial Fertilizer, vol. 29, No. 3, p. 50, October, 1924.

Cartago, on Owens Lake, Owens Valley, and to the Dolbear process of extraction of potash and other salts from Searles Lake brine. (See p. 39.) No production has yet been reported to the Geological Survey, which collected the statistics on which this chapter is based.

MARYLAND

U. S. Industrial Chemical Co.[10]—The addition to the plant of the U. S. Industrial Chemical Co., in the Curtis Bay section of Baltimore, Md., was recently completed at a cost of $750,000. The company plans to develop its full capacity. The works produce potash, ammonium sulphate, and kindred chemical products, using as raw material the refuse of the neighboring plant of the U. S. Industrial Alcohol Co., an affiliated organization that manufactures alcohol under a special process from molasses. It is the only potash producing works in this section of the country and the only one of its kind reporting production to the United States Geological Survey. In 1924 it produced 10,302 short tons of crude material averaging 33.3 per cent K_2O.

NEBRASKA [11]

The Standard potash plant at Lakeland, Nebr., has been sold at auction by order of the Federal court. Max Grimes, of Denver, was the successful bidder, at $20,000. Upon confirmation of the sale the structures will be dismantled and the residences sold. This plant was originally organized by Omaha and Council Bluffs capitalists and was considered one of the best among the plants in the potash fields of western Nebraska.

UTAH

Considerable activity has been shown in prospecting and acquiring lands in the Great Salt Lake Desert, of Utah, which is underlain by potash-bearing brines. In 1917 the production of potash was begun at Salduro, in this region, by the Solvay Process Co. In 1918 this company turned over its interests to the Utah-Salduro Potash Co., a subsidiary, which continued production until 1921, when, owing to changes in the parent company, the plant was shut down. In 1920 the Utah-Salduro Potash Co. was the largest individual potash producer in the United States. The plant was on the Western Pacific Railroad 60 miles west of Great Salt Lake. The deposit from which the potash was extracted has been described in Mineral Resources, 1916–1920. The brine is similar in composition to the artificial brines of the German potash works. Solar evaporation produces crude salts containing potassium, sodium, and magnesium chlorides. These crude salts may be boiled with hot brine and on cooling yield high-grade potassium chloride. Solar evaporation permits a great saving of fuel.

It was felt by many that abandonment of this project by the parent company was not justified by the conditions then prevailing. New interest has been aroused by the attempts of groups of persons with patent or permit rights to raise funds to renew operations in the region on a larger scale.

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[10] Am. Fertilizer, vol. 60, No. 12, p. 29, June 14, 1924; Chem. and Met. Eng., vol. 31, No. 4, p. 166, July 28, 1924.

[11] Am. Fertilizer, vol. 61, No. 1, p. 30, July 12, 1924.

There is little doubt that the quantity of available brine is large and that the technology of extracting chlorides from it is relatively simple. The question seems to be largely whether the cost of production can be made so low that when transportation charges to eastern markets are added the product can be sold in competition with imported potash salts. There would seem to be some justification for the view that if operations are undertaken on an appropriate scale this result may be accomplished. The outcome of the proposed developments will be awaited with interest.

G. M. Winkleman, of the Aluminum Potash Co. of America, has been conducting a series of experiments, in cooperation with the station of the Bureau of Mines at Berkeley, Calif., looking to the recovery of potash and aluminum salts from Utah alunite. It is reported that he has bought an old plant at Bay Point, Calif., where experiments on a larger scale are now under way.

POTASH-BEARING SHALES IN MINNESOTA

Harrison A. Schmitt[12] in a recent article calls attention to the Decorah shale as a source of potash. This formation, which is of Ordovician age, lies just below the Galena formation, which itself contains layers rich in potash. The whole area underlain by the Decorah shale is covered with glacial drift, thickly populated, well farmed, and accessible to railways and good roads. At St. Paul the formation is 60 feet thick, including 50 feet of green clay shale and 10 feet of limestone low in magnesia (MgO). The limestone layers increase in number and thickness toward the top, where they merge with the Galena formation, which is about 40 feet thick and consists about half of limestone and half of shale of the same character as the Decorah, rich in potash (K_2O).

After discussing various processes for the extraction of potash from silicates and numerous tests and experiments made to study the characteristics of the shale, Schmitt concludes:

> The Decorah shale in Minnesota is an extensive potash-rich shale (6 to 8 per cent K_2O).
>
> The potash is in two states of combination, about 60 per cent of it more easily available than the rest.
>
> Much potash can be obtained from this shale by heat treatment with sodium salts equivalent in amount to the K_2O and with a slight excess of $CaCO_3$.
>
> The potash in the Decorah shale can be rendered soluble and volatilized in part from bricks where salt and $CaCO_3$ have been added to the raw shale.
>
> The Decorah shale is favorably situated for use with sand if a by-product from potash extraction is suitable for sand-lime brick, as in a greensand process already patented.
>
> The Decorah shale is also situated near some limestone which may be suitable for Portland cement. The Decorah is probably suitable for use in a cement mix.
>
> The Decorah is being tried, without preliminary heat treatment, with considerable promise of success, as a fertilizer for potash-deficient soils which are common near some of its outcrops.

Although the time does not seem to be ripe in this country for the successful extraction of potash from potash-bearing silicates, the location of an apparently abundant source of this material in Minnesota is not without economic interest.

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[12] Schmitt, H. A., Possible potash production from Minnesota shale: Econ. Geology, vol. 19, pp. 72–83, 1924.

PROCESSES FOR POTASH EXTRACTION

DOLBEAR PROCESS FOR TREATING SEARLES LAKE BRINE

C. E. Dolbear has devised a process for treating Searles Lake brine that involves the crystallization of the crude salts by solar evaporation and their subsequent treatment with hot brine. The potassium chloride and borax of the crude salts are dissolved by the brine, but the other contained salts are not affected and may be separated in centrifugal machines. The hot brine is then cooled in a quiescent state, thus allowing the potassium chloride to crystallize out, while the borax remains in supersaturated solution. If the cooled brine is agitated the borax crystallizes out, making an unusually complete separation. The potassium chloride and borax are washed in centrifugal machines, and a product of great purity is obtained. The brine may be used again for the treatment of more salts.

The process includes the separation and recovery of the sodium chloride, sodium sulphate, and sodium carbonate of the leached salts first by treatment with a solution of sodium chloride to dissolve the sodium carbonate and the sodium sulphate. The sodium chloride of the salts remains undissolved, and may then be separated out in a centrifugal machine in highly pure form. Very little washing is needed. The sodium carbonate of the remaining solution is next precipitated in the form of sodium bicarbonate by the addition of carbon dioxide gas. It is then centrifuged and calcined to soda ash. The remaining brine containing sodium chloride and sodium sulphate is treated with ammonia gas, and sodium sulphate is precipitated in an anhydrous condition and is separated from the brine in a closed centrifugal machine.

The ammoniacal sodium chloride brine is heated in a still, and the ammonia is distilled off for further use in precipitation of another batch of sodium sulphate; the sodium chloride solution is saved for treating a new batch of the leached salts.

This process, which is controlled by the Inyo Chemical Co., of Reno, Nev., was demonstrated in Detroit before representatives of the Detroit section of the American Institute of Chemical Engineers in April and May, 1924. The above account is based on a statement published after the demonstration.

The process as described is covered in its essentials by patents Nos. 1496152 and 1496257,[13] issued to C. E. Dolbear June 3, 1924.

It is claimed by Mr. Dolbear that the adoption of this process will result in large savings over that now employed in the commercial extraction of potash and borax at Searles Lake, especially if the crude salts obtained by solar evaporation are shipped for treatment to the Pacific seaboard, where labor and fuel may be had more cheaply.

UTILIZATION OF ALUMINUM-POTASSIUM SILICATES

The problem of utilizing silicates containing potassium and aluminum still continues to command attention. During the World War emphasis was placed only on the extraction of potash, but it is now realized that if the potash is to be extracted on a profitable basis the alumina and perhaps other constituents must also be utilized to distribute costs and to procure other marketable products.

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[13] Bragg, C. T., and Putnam, W. P., Conquering natural brines for commerce: Chem. and Met. Eng., vol. 31, No. 12, pp. 468, 469, Sept. 22, 1924.

Recent experiments on this problem have been conducted by C. Montemartini and L. Losana,[14] who treated mixtures of aluminum-potassium silicates with carbon at high temperatures in a current of nitrogen, with these results: (1) All the potassium distills, and a small part changes to cyanide. The proportion of cyanide formed is influenced by the quantity of carbon added to the mixture and by the mass of the mineral matter. (2) The residue that does not distill fixes perceptible amounts of nitrogen (about 13 per cent), forming nitrides. The amount of nitrogen fixed is in excess of that necessary to form a nitride with all of the aluminum; hence some nitride of silica is also formed. (3) The quantity of carbon added to the mineral has an influence upon the general course of the reaction in addition to that upon the formation of the cyanides. (4) The nitrogen may be set free from the nitrides of aluminum and silicon by heating them at about 1,000° in a current of dry gaseous hydrochloric acid (HCl) with the formation of chlorides of ammonia, aluminum, and silicon.

PROCESS FOR OBTAINING SOLUBLE POTASSIUM AND SODIUM SALTS FROM INSOLUBLE MATERIALS

According to a letter to the Bureau of Foreign and Domestic Commerce from James F. Hodgson, United States commercial attaché at Prague, a new process for the recovery of potash from insoluble materials has been discovered by Otto Lederer and Walther Stanczak, who are holders of the patents for the process. The following account is taken from a translation kindly furnished by the bureau:

> It has been found that alkali sulphates may be obtained from insoluble minerals without the necessity of resorting to [previous] heating and thereby incurring large expense; furthermore, repeated crushing of the mass is avoided. * * * The finely crushed mineral, mixed with alkaline earth, oxides, or carbonates, or with magnesium compounds, also with any kind of sulphate and ammonium carbonate, is stirred with water and heated while the mixture is being stirred, under pressure, if necessary, as a result of which the potash and sodium are changed into sulphates which may be obtained through filtering and washing.
>
> *Example:* 6 kilograms of feldspar containing about 8 per cent K_2O and 3 per cent Na_2O; 18 kilograms of calcium oxide, or the proper amount of limestone; 3 kilograms of gypsum raw; 1 kilogram of ammonium carbonate.
>
> This mixture is treated in the manner described above. The dissolved lime is precipitated with carbonic acid, while the ammonia separates the silicic acid and the clay that have been dissolved.
>
> The product amounts to about 90 per cent of the total quantity of alkalies that were contained in the material treated. The escaping ammonia is recovered. The residue left after washing is used in the ordinary way for the production of cement. Instead of using ammonium carbonate, the mixture may also be made with carbonic acid.

POTASH FROM CEMENT DUST

Potash in volatilized form has long been recognized as a constituent of the dust that ordinarily escapes from cement mills. During the World War considerable amounts of this potash were recovered by electric precipitation and by washing. In 1918, the year of greatest production, 12 cement plants produced 12,652 short tons of crude salts containing 1,549 tons of potash (K_2O), or 3 per cent of the total production for that year. With the reimportation of foreign potash and the resulting drop in prices most of these cement mills found it unprofitable to continue the recovery of potash, and in 1924 only one such mill reported production to the Geological Survey.

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[14] Montemartini, C., and Losana, L., Gior. chim. ind. applicata, vol. 5, pp. 487–495, 1923.

Experiments designed to promote the resumption of this activity by the cement mills and the recovery of potash at lower costs have been conducted by E. J. Fox and C. W. Whittaker, of the Bureau of Soils,[15] who have undertaken the fractional separation of cement dusts by air separation. Some of the results of this work are cited below.

> Fractions of cement dusts, the potash contents of which are approximately double those of the original materials, were obtained by air separation. In no instance was all the potash obtained in one fraction of the material, regardless of the size of the fraction.
>
> In all the fractions of a given sample the potash content decreased as the size of the particles increased.
>
> The potash is apparently present on the surface of the dust particles, and the distribution of the potash over all surfaces is apparently equal.
>
> The concentration of the potash was apparently due to the increase in the aggregate surface obtained in the finer fractions.

Differences between acid-soluble and water-soluble potash contained in dusts from coal-burning kilns are thought to be due to the adsorption of a portion of the potash by carbon residues in such dusts. These residues have had their volatile constituents driven off and are thought to be porous. Potash fume is doubtless deposited in the pores and becomes practically inaccessible to water. Acid, however, will dissolve certain of the water-insoluble compounds that may coat the carbon particles, and the potash contained in the particles will thereby be exposed.

GOVERNMENTAL ACTIVITIES

Potash is typical of those subjects which have to be considered by the Government from different viewpoints and therefore involve the activities of more than one branch of the Government service. In 1924 five bureaus were concerned with the subject of potash, but although the work of these bureaus was closely related, there was little if any overlapping or duplication of effort.

GEOLOGICAL SURVEY

The activities of the Geological Survey in 1924 relative to potash were concerned chiefly with the Texas potash field. (See p. 45.) Walter B. Lang, the Survey's representative, with field headquarters at Midland, Tex., visited all available wells, interviewed drillers, and procured samples of cuttings and brines, which were analyzed at the laboratories of the Survey in Washington.

In addition G. F. Loughlin examined a tract of alunite-bearing land near Marysvale, Utah, for which application for patent had been made. This deposit is briefly described on page 46.

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[15] Fox, E. J., and Whittaker, C. W., Potash from cement dust: Ind. and Eng. Chemistry, vol. 16, No. 10, pp. 1044–1046, October, 1924.

Samples from a well in Grand County, Utah, forwarded to the Survey, were also analyzed at the laboratory in Washington and were found to contain potash. This interesting occurrence is reviewed briefly on page 46.

Publications during the year included the annual chapter on potash in Mineral Resources for 1923 and Press Notice No. 18209, Potash in the Cowden well, Crane County, Tex.

BUREAU OF MINES

The Bureau of Mines, which was charged with the administration of leases under the potash leasing law, was actively occupied during the year with that work. The bureau has kept in touch with potash activities in general but did not in 1924 initiate any investigations relating to the subject. In April, 1925, however, the bureau cooperated with the Geological Survey and the General Land Office in a survey of leasable potash lands in northeastern Utah.

According to tabulations reported through H. I. Smith, March 31, 1925, a total of 483 permits and leases, covering 1,097,396 acres, had been granted to mine potash on the public domain. The terms of these permits and leases provide for an initial investment of approximately $2,926,470 and the payment of a royalty to the Government on all potash produced. The distribution of these permits and leases by States is as follows: Utah, 302; California, 83; Nevada, 72; New Mexico, 10; Arizona, 4; Nebraska, 4; Colorado, 3; Montana, 2; Idaho, 1; Oregon, 1; Wyoming, 1. Practically no production has thus far resulted from these leases.

BUREAU OF SOILS

The Bureau of Soils has continued its researches in technologic processes for the extraction of potash as a by-product both from industrial wastes and from natural raw materials. The following account taken from a letter to the writer from J. W. Turrentine, scientist in charge of the bureau's potash investigations, outlines the general scope of the work. The activities of the bureau in the development of methods of extracting potash from kelp have already been described in technical journals and have been referred to in previous volumes of Mineral Resources.

> American potash resources, it is now established, are enormous in extent and are practically inexhaustible. For the most part, however, due to the lack of technical knowledge of processes of extraction they can not be successfully exploited in competition with European potash. To secure cheap potash from these raw materials methods must be employed which make possible the recovery of any other ingredients of value which they contain, so that the cost of extracting the potash may be reduced proportionately. This is the fundamental problem with which this bureau is now engaged. Substantial progress has been made to date, more than is represented by the present American industry, although that industry as now operated produces 44,000 tons of potash salts per annum, representing 10 per cent of our requirements. * * *.
>
> But the two greatest known resources among the natural potash carriers and industrial wastes, respectively—namely, greensands and blast-furnace dust—are not yet under successful exploitation, and it is to these materials particularly that the present greatly restricted potash researches of this bureau are being applied.
>
> Greensand deposits cover large areas in the States of New Jersey, Delaware, and Maryland and are ideally situated from the commercial point of view. According to the Geological Survey they contain potash enough to supply American agriculture for a thousand years. The solution of the problem of extracting

potash therefrom, accordingly, might mean the solution of the American potash problem. The problem is one of by-products, and the work has now progressed to the point where all the constituents of the raw material—potash, alumina, iron oxide, and silica—are rendered into valuable commodities by a simple and inexpensive process.

The extraction of greensand with sulphuric acid, under proper conditions, we have just disclosed, leaves siliceous skeletons of the original grains which have high adsorptive properties, similar to those of silica gel, and which apparently will prove a valuable material for the purification of petroleum products and various other materials purified by adsorptive methods.

Since it was already believed that with only alumina and iron oxides as by-products the extraction of potash from this mineral was commercially feasible, in view of the great contribution to the values obtainable which this new siliceous product represents, it is believed that the present development will prove the solution of the problem of the profitable extraction of potash from greensand.

All the products here obtainable are marketable in large tonnage, so that any industry established on this basis can grow to large dimensions before the saturation point of the market is approached.

Researches now in progress on this problem are designed to further improve the siliceous product and methods of applying it, particularly to oils, and to further perfect the separation of the other products from one another in a state of increased purity, the development of ochers from the iron compounds obtained, and the recovery of by-product sulphuric acid.

The recovery of potash from blast-furnace dust is being studied. Here is a potential source of potash capable of supplying some 200,000 tons K_2O annually, approximately enough to supply American agriculture at the present rate of consumption. Dry methods of cleansing blast-furnace gases, which make potash recovery a simplified matter, stand on their own economic basis, due to the great conservation of heat and enhanced efficiency which they afford, in view of which their general adoption seems inevitable. The application of the Cottrell precipitator to this use, after a period of experimentation, has now been perfected and appears the ideal solution of the problem. It yet remains to be shown how the potash-bearing dust may best be treated to effect a further concentration of the potash. While it can be marketed direct as a low-grade potash carrier, high freight rates and the increasing demand that fertilizer ingredients be in concentrated form make it highly desirable that the blast-furnace industry be shown how best to manipulate this product for fertilizer use.

Cement dust, as a source of potash, has received a good deal of attention in this bureau for some years past. Surveys have shown some 85,000 tons K_2O to be available annually from this source, and dust recovery enforced by other considerations has brought potash recovery closer to realization. Recent new developments in the Cottrell precipitator, increasing its efficiency and greatly reducing its cost of installation and operation, have given fresh impetus to this activity.

The concentration of the potash of the dust appears to be a relatively simple matter. The application of air-elutriation methods, as recently shown in this laboratory, effects a doubling of potash content at a minimum of expense and installation and without the use of water solution and the complexities attendant thereon. But this is not the complete solution of the problem, and it is hoped that the related researches on potash extraction from blast-furnace dust can be made to apply also to cement dust.

Another mineral deposit ideally situated with respect to agricultural areas, the Georgia shales, contains large supplies of potash in workable concentration. Experimentation with this material indicates that it can be made a commercial source of potash with the aid of alumina as a by-product. Methods developed in this research should be applicable also to the feldspars.

The Italians are now successfully producing potash from leucitic lavas. There are large surface deposits of such in America which may be found to be workable by a similar process, although other mineral deposits more advantageously situated with respect to the fertilizer market should receive earlier attention.

In the case of all potassium-aluminum silicates the solution of the economical recovery of potash lies in the recovery of alumina as the main product. This valuable ingredient has heretofore been largely ignored. Approached from this angle the problem appears much simplified, and the recovery of potash from silicates appears entirely feasible.

The establishment of an adequate American potash industry is yet to be realized, but the progress made to date and the new results now in hand promising the early exploitation of new great sources of potash can not be considered as anything less than highly encouraging. American potash of superior grade is now underselling the inferior European commodity. American potash will mean cheap potash, because it will be by-product potash and because it will be produced close enough to the farms where used to greatly reduce transportation costs. The small industry now established not only successfully meets the most ruthless European competition but stands ready to expand in response to any increase in price exacted by the European monopoly.

It is our purpose to contribute information on such critical points as will aid the development of the American industry to the point where, from the great wastage now occurring daily and the great mineral deposits now lying idle, American potash will be produced to provide liberal and cheap supplies for the use of the American farmer.

BUREAU OF FOREIGN AND DOMESTIC COMMERCE

The Department of Commerce was granted during the year 1924 a special appropriation of $500,000 to investigate essential raw materials that are more or less under foreign monopolistic control. When the Franco-German potash agreement was signed (see p. 34), the Bureau of Foreign and Domestic Commerce determined to make a survey of potash under the terms of this appropriation. According to a letter to the writer from C. C. Concannon, chief of the chemical division—

> The work was actually undertaken beginning about the end of the year, and a mass of documentary material is now being worked into shape for ultimate release as a special bulletin on the subject of potash. This will be a historical résumé of the developments within the potash syndicate from the inception of the potash industry and will bring the story up to date in as much detail as possible. * * * We shall, of course, confine ourselves largely to the economic and commercial aspects of potash.

BUREAU OF STANDARDS

In the course of their study of wastes from the beet-sugar industry members of the Bureau of Standards have been experimenting upon the recovery of potash from waste water obtained through the Steffens lime process. For some years past this waste water has been utilized by certain factories for the recovery of small amounts of potash. In 1919, according to figures reported to the Geological Survey, a maximum of 12,423 short tons of crude material, containing 3,601 tons of K_2O and comprising 11 per cent of the total potash production for the year, was produced by 11 plants, but with the decline in prices accompanying the renewal of importations the number of plants has been greatly reduced and in 1924 there was only a single plant, which reported a small tonnage. The work of the Bureau of Standards has in view the perfection of methods by which the potash now annually wasted in the manufacture of beet sugar, estimated at about 12,000 tons of K_2O, may be recovered at a profit. A brief paper[16] describing preliminary experiments shows a possible yield of 227 pounds of crude salt, or 199 pounds of recrystallized salt, from each ton of concentrated waste water produced.

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[16] Geldard, W. J., and Chase, W. D., A lesson in waste recovery: Chem. and Met. Eng., vol. 32, No. 5, pp. 195-197, Feb. 2, 1925.

INVESTIGATIONS BY THE GEOLOGICAL SURVEY

TEXAS

The most significant results of the year in Texas were obtained from the Cowden well, in Crane County; the Mid-Kansas Harris Bros. well, in Crockett County; the Texon No. 1 (group 1) well, in Reagan County; and the Gray No. 1 well, on the Markham dome, in Matagorda County

The Cowden well was described in Press Notice No. 18209, released January 26, 1925. Sampling was done perhaps more carefully at this well than in any well previously tested by the Geological Survey. Although the best sample contained only 7.40 per cent of potash (K_2O), the physical character of the material at two horizons was such as to suggest that by simple methods of concentration under ordinary methods of mining it might be possible to improve the grade of the material. Had this well been core drilled, information would have been available about the thickness of individual beds and the possibility of concentration by hand sorting.

The Mid-Kansas Harris Bros. No. 1 well supplied 13 samples, two of which from depths of 1,260–1,310 and 1,350–1,390 feet yielded upon analysis 8.92 and 8.35 per cent of K_2O, respectively. These samples were not only richer than the others, but their physical character suggests the presence of well-bedded deposits of polyhalite. The samples, however, are random samples taken from a large interval; hence they can not be considered representative.

The Texon well No. 1, group 1, in section 1, block 8, Reagan County, furnished 51 samples from depths of 1,220 to 1,840 feet, chiefly at intervals of 10 feet. The best sample, containing 9.56 per cent K_2O, equivalent to 16.03 per cent in the soluble salts, was taken between 1,405 and 1,415 feet. Other samples contained the amounts of potash here specified: 1,340–1,350 feet, 6.41 per cent in sample, equivalent to 7.8 per cent in soluble salts; 1,370–1,380 feet, 4.40 per cent in sample, equivalent to 4.72 per cent in soluble salts; 1,580–1,600 feet, 4.46 per cent in sample, equivalent to 5.38 per cent in soluble salts; 1,650–1,660 feet, 7.80 per cent in sample, equivalent to 9.21 per cent in soluble salts. There were 10 other samples distributed fairly well through the set that contained more than 1.50 per cent of K_2O.

An interesting discovery of potash is reported[17] to have been made in the Markham salt dome, near Markham, Matagorda County, Tex. (Gray No. 1 well). The potash was found in a core of salt taken at a depth of 4,800 feet. The sample contained about 15 per cent of K_2O in the form of chloride. Preliminary study shows that the potash mineral is probably sylvite, a common potash mineral of the Alsatian field.

Both wildcatting and drilling for oil in the producing fields have increased the number of wells from which potash has been recovered. There are now about 20 counties and more than 30 wells that have furnished potash data.

It seems probable that the region extending in a southeasterly direction from Lea County, N. Mex., to western Crockett County,

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[17] De Golyer, E., New light on the origin of North American salt domes: Mining and Metallurgy, vol. 6, p. 82, February, 1925.

Tex., is likely to prove the most favorable area for potash exploration. The available cuttings from wells in this region show that it is underlain by many potash-rich horizons. A fuller account of the Geological Survey's explorations in Texas in 1924 is given in a bulletin by W. B. Lang, now in preparation.

UTAH

Alunite.—On September 13 and 14, 1924, G. F. Loughlin and V. C. Heikes, of the Geological Survey, made an examination of land in sections 21, 20, 17, and 8, T. 26 S., R. 4 W., near Marysvale, Utah, in connection with the patent application of J. G. Pierce. Check samples were taken at several places. As reported by Mr. Loughlin the results of the examination are discouraging, for the quantity of high-grade alunite that can be mined on a commercial scale is too small. The potash content of two of the three samples analyzed in the Survey laboratory, in which both potash and soda were determined, is less than the soda content, showing that considerable soda alunite is present and suggesting that in former analyses of samples from these claims the soda and potash may not have been separately determined. The largest deposits, where considerable development work had been done, have a fairly large gross tonnage but are below commercial grade and are shallower than their prominent outcrops would lead one to expect.

Carnallite.—Salts submitted to the Geological Survey and reported to have been taken from a depth of 3,150 feet in the Crescent Eagle oil well, 7 miles west of Thompsons, Grand County, Utah, have proved to be carnallite. This is one of the principal potash minerals of the German potash field, and so far as known to the writer the occurrence here is the first reported for this mineral in the United States. The potash content of the sample submitted was 13.9 per cent, as compared with 14.1 per cent for pure carnallite.

A second occurrence of potash salts has been reported in the same well at a depth of 3,910 to 3,917 feet. In physical appearance these salts, as submitted to the Survey laboratory, closely resemble those from the higher level, but the potash content is much greater, being 49.05 per cent. This high percentage of K_2O appears to indicate a mixture of carnallite and sylvite, as no sulphate is present. These occurrences are described in greater detail in the bulletin by W. B. Lang above mentioned.

The presence of these salts in this well is not yet understood. Fortunately other wells are being drilled in the same general region, and it is hoped that data may be obtained from them that will assist in the solution of the problem.

Brines.—Private activities at Salduro, in northwestern Utah, have already been referred to (p. 37). At the request of the Secretary of the Interior, to assist the department in administering leases in this region, the Geological Survey, in cooperation with the Bureau of Mines and the General Land Office, began in April, 1925, a survey of the Great Salt Lake Desert, including Salduro, in order to delimit leasing ground from prospecting ground. This work, which involves boring many shallow holes and the taking and analyzing of many samples, is being done by T. B. Nolan, of the Geological Survey.

OTHER INVESTIGATIONS

In addition to the work already described the Geological Survey is receiving and analyzing samples of materials supposed to be potash-bearing in the form of brines, salts, and rocks from many parts of the country. Little of public interest has been found in these examinations.

PROPOSED LEGISLATION

During 1924 and until the adjournment of Congress on March 4, 1925, considerable interest was maintained in two bills affecting potash exploration and the disposal and operation of public lands containing potash. The first bill (S. 3047), introduced by Senator Sheppard, of Texas, provided for the expenditure by the Geological Survey of $500,000 annually for five years for the exploration of natural potash salts in the United States. The bill also provided for the expenditure by the Bureau of Soils of $50,000 annually for the same period for the investigation of by-product potash production from industrial wastes and refractory natural materials such as greensand and leucite. One purpose of this bill was to provide adequately for core drilling in the Texas potash field.

The other bill (S. 3005), introduced by Senator Ladd, of North Dakota, was designed to correct certain abuses that have arisen in connection with the present potash-leasing law. It would have done away with the provision permitting the issuance of a patent for a quarter of the land covered by a prospecting permit and would have made the provisions for leasing and operating potash lands the same as those for coal, phosphate, oil, oil shale, gas, and sodium lands.

Both bills made rapid headway for a time but finally failed of enactment.

TARIFF READJUSTMENT

On April 11, 1925, President Coolidge ordered an increase in the tariff duty on potassium chlorate from 1½ cents to 2¼ cents a pound. The President's action was in accord with the "flexible" provisions of the tariff act, which authorize him to change rates to a maximum of 50 per cent—the increase here granted. It was based on a unanimous report recommending a higher duty submitted by the Tariff Commission, which stated that the increase was needed to equalize the cost of production in the United States with that in Germany, the principal competing country. The product is used in the manufacture of matches and fireworks, as an oxidizing agent in cloth printing, and for medicinal purposes.

NOTES ON FOREIGN POTASH

GERMANY

General market conditions.—Aside from a short-lived domestic boom at the beginning of the year and a period of slow recovery during the last quarter, the year 1924 in Germany was one of financial stringency, general liquidation, and severe unemployment. Local price levels were above world levels, a difference that restricted foreign trade to a considerable extent and reduced domestic consumption. This transition period was unavoidable, as the cost of stabilization of the currency and the balancing of the budget was met by extremely high taxation and a policy of violent credit restriction.

The sales of German potash in 1924 amounted to 824,000 tons of pure potash (K_2O), compared with 885,942 tons in 1923, 1,295,579 tons in 1922, and 1,110,369 tons in 1913. The year was an extremely poor one for the potash industry, sales at home and abroad being adversely affected by money tightness and credit shortage and by the poverty of the agricultural industries throughout the world. At one time during 1924 the industry had only about 50 shafts in operation, and some of these were on part time. The conclusion of the Franco-German potash pact on August 14 stimulated the industry generally and put a stop to cutthroat competition between the two groups selling to the United States market.[18]

According to Trade Commissioner W. T. Daugherty,[19] of Berlin, exports of potash fertilizers, amounting to but 337,400 tons of pure potash in 1924, reached only 66 per cent of the corresponding sales of 506,087 tons in 1913. The decrease is attributable to postwar competition by France, which under the peace treaty acquired former German potash mines in Alsace-Lorraine. There is scarcely any doubt, however, that this industry will expand its export sales in large measure in coming years. Direct by-products from the German potash mines and electrochemical products from waste liquors of potash, or from sodium chloride, which is abundantly present in the potash deposits, will be sold in greater quantities in export markets in the future. Germany's potash deposits are unquestionably the nearest approach to a monopoly that that country has in chemical production.

Improvement in conditions in 1925 has already been observed. The German potash syndicate sold 201,867 metric tons of K_2O in February, making the total sales in January and February 367,863 tons. During January and February, 1924, sales aggregated only 112,908 tons. According to Mr. Daugherty orders booked indicated that business in March would probably be very satisfactory.

Wintershall group.—According to a report from United States Consul F. T. F. Dumont, at Frankfort on the Main, dated January 15, 1925, the Wintershall group in the potash syndicate continues to support its policy of cheap prices as the only one suited to improve and stabilize conditions in the potash industry. Since the conversion of its capital to a gold basis and the final settlement of its Swiss-franc debts, the concern has shown renewed activity and is attempting to enlarge its group, which already has a 42 per cent allotment of the total sales of the syndicate. Apparently these efforts are addressed to two organizations—the Burbach concern and the Prussian Bergfiskus (Prussian State Mine Administration), of which the former participates in the syndicate's total sales to the extent of 8.7 per cent and the latter 5.9 per cent. By gaining control of these two organizations, or reaching an agreement with them, the Wintershall group would have a majority in the syndicate and could follow out its policy unimpeded by small works that have relatively poor deposits and high costs of production and are consequently interested in selling at high prices. Operations would be concentrated in mines that have easily accessible, rich deposits, a policy which would greatly cheapen the costs of production and allow a reduction in prices. It is stated that a friendly understanding has been reached with the Burbach concern and that an agreement has been drawn up ready for the signature of the Prussian Bergfiskus and the Kali Industrie A. G. (the Wintershall holding company). This agreement states that it is intended to "insure cooperation in certain questions concerning the potash industry, to facilitate the exchange of opinions concerning mining operations and price policy."

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[18] Commerce Repts., Jan. 5, 1925, p. 18; Mar. 9, p. 556.

[19] Commerce Repts., Apr. 6, 1925, p. 23; also Bur. For. Dom. Commerce Special Circ. 94, Apr. 21, 1925.

The Wintershall group was the first to advocate the understanding with Alsatian potash producers. Herr Rosterg, the leader of the group, stated at the general meeting of the Deutsche Kaliwerke that it would have been better for both parties if the agreement had been reached much earlier. He claims, however, that the foreign market quota assigned to the Upper Alsatian mines is too high. It seems probable that once the cost of production in Germany is lowered and sales increase, German efforts will be made to reduce this quota.

In regard to the American influence in the Wintershall mining company, which is the leading company in the group of that name, it appears that only 200 or 300 shares belong to the Zimdin-Dollar group and that a pooled majority of the remaining shares is owned by Germans. Mr. Zimdin, however, was lately made a member of the managing committee of the Wintershall mining company.

The question of the acquisition of increased influence by the Wintershall group [20] is one of incalculable importance, not only to the potash syndicate, but the German national industry as a whole. It is not to be doubted that the Prussian Government will be unwilling to acquiesce in a seizure of power by a member of the syndicate, particularly inasmuch as a drastic change of policy is involved. German industrialists are agreed that a cautious advance toward a gradual transition is more suitable to the needs of the potash industry at the present time than an about-face engineered by an ambitious group which appears to be concerned principally with its own interests. In the last analysis it is the Prussian Government which must take steps, if necessary, to prevent the formation of a potash trust under the leadership of the Wintershall group.

German holdings of Virginia-Carolina Chemical Co.—It is reported [21] that with the approval of Judge William N. Runyon in the Federal court at Newark, N. J., receivers for the Virginia-Carolina Chemical Co. in February disposed of the Prinz Adelbert potash mines, in Germany, for $2,052,000, of which 10 per cent was in cash. The purchaser was Herbert M. May, who declined to divulge the identity of his principals. It was reported in trade circles, however, that the buyer was the Wintershall group of Germany.

Magnesium waste liquor from German potash.[22]—On the basis of pre-war production of potash in Germany 700,000 to 800,000 tons of magnesium chloride and 80,000 to 100,000 tons of magnesium sulphate are going to waste annually in the waste liquors from potash-refining plants. The possible recovery and marketing of these substances as an adjunct to the potash industry constitutes an important problem.

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[20] Report of United States Vice Consul Paul Bowerman, Berlin, Jan. 19, 1925.

[21] Oil, Paint, and Drug Reporter, p. 20, Feb. 23, 1925.

[22] Daugherty, W. T., cited in Am. Fertilizer, vol. 62, No. 2, pp. 28, 29, Jan. 24, 1925.

A small amount of this material is recovered and sold. Thus in 1923 Germany produced and sold about 58,000 tons of specially prepared magnesium chloride. The thermal decomposition of 800,000 tons of magnesium chloride would yield about 335,000 tons of magnesia and about 1,840,000 tons of 20° Baumé hydrochloric acid, but the total pre-war production of hydrochloric acid in Germany amounted only to about 300,000 tons. It is impossible to load the world market with such quantities of either magnesia or hydrochloric acid, though the magnesia made as a by-product from the potash industry is more readily absorbed than the hydrochloric acid.

Evaporation of this waste liquor throws down crystallized and "melted" magnesium chloride, mixed with minor quantities of other salts. The crystallized magnesium chloride sells for about 5.50 marks per 100 kilograms, exclusive of packing, and the melted product for 5.25 marks. This by-product of potash could be made more profitable commercially if the capacity of certain industries for consuming it could be increased, such as the textile industry, the industry of wood preserving, or the manufacture of "hard wood," (Steinholz). The crude magnesium chloride liquor can be used as a dust layer on streets, as a spray, as a binder in the manufacture of briquets, or as a mineral lubricant.

The modern development of the waste-liquor refining process involves dehydration of the melted magnesium chloride to form the preferred so-called "four" and "two" concentrates ($MgCl_2.4H_2O$ and $MgCl_2.2H_2O$, respectively), because these are more effectively handled bulk products. The pyrogenous decomposition of these hydrates forms concentrated hydrochloric acid and makes easier the production of "hard wood" and the electrolytic winning of magnesium metal. The making of artificial magnesite is also considered. If successful this process would emancipate Germany from a relatively large importation of magnesite (chiefly from Austria, Czechoslovakia, and Greece), amounting in 1922 to 61,308 metric tons and in 1923 to 30,769 tons.

New potash mine in Baden.—According to a letter from John E. Kehl, United States consul at Stuttgart, dated November 26, 1924, boring for potash began in 1911 at Buggingen, a village situated in the Lörrach district, between Mannheim and Constance, Baden. It is believed that the Alsatian deposits reach into the State of Baden and that a nominal production may be realized at Buggingen. The government at Baden holds a one-third interest in this prospect; the remaining two-thirds is privately owned.

At the outbreak of the war operations ceased, and no further work was done until 1922, when work was again made possible through financial assistance given by the State of Baden, which entered into the project solely for the promotion of agriculture.

From the beginning difficulties were encountered in boring and sinking the shaft, but it has now been made waterproof with cast-iron tubing down to a depth of 420 feet and thence down is fortified by masonry work measuring 16½ feet in diameter.

At the time the communication was written the shaft was down 1,600 feet, but it was expected that the potash bed, shown by borings to be 14 feet thick and of high grade, would be reached in the summer of 1925 at a depth of 2,460 to 2,780 feet. In order to insure safety in mining operations and to increase the output a second shaft is being sunk at a distance of 200 feet from the first shaft.

FRANCE

Production.—The production of potash in France in 1924 (see world table, p. 57) was 271,624 metric tons of K_2O, as compared with 248,528 tons in 1923 and 211,675 tons in 1922, thus showing a steady increase. The production in 1924 might have been still greater had it not been for labor troubles. Conditions at the mines are said to be satisfactory, and a further increase in production is expected for 1925.

Government purchase of mines.—It is announced from Mulhouse [23] that a decision has been made by the French Government to take over the Alsatian potash mines. The Government becomes the owner of the mines through a payment of 20,000,000 francs, to be liquidated in 20 years. These mines were formerly the property of the German Government and German industrialists. The management of the property has been turned over to an exclusively French corporation. It is proposed to require that certain proportions of the potash put on the market shall be at the disposal of French farmers.

The law permitting the purchase of the sequestrated potash mines of Alsace was passed on March 26, 1921, but the sale did not take place until May 24, 1924.[24] A decree dated August 22, 1924, published in the Journal Officiel of August 31, 1924, provides (article 1) that until the promulgation of the law fixing the conditions of exploitation of these mines their operation shall be assured by a director appointed by the Minister of Public Works and acting under his authority. Article 2 provides for an advisory council to consist of three members representing the public works administration, two members designated by the Minister of Finance, two members designated by the Minister of Agriculture, one member designated by the Minister of Labor and Public Health, two representatives of agricultural associations, one representative of the chambers of commerce, and one technician of the mining industry. Article 3 provides for the establishment of an annual budget and for supplementary credits. Article 4 makes the director responsible for receipts and disbursements and provides for accounting. Article 5 provides for a scale of wages, salaries, and for accessory advantages to the personnel.

Present situation of Alsatian mines.[25]—The potash mines in Haut-Rhin, near the city of Mulhouse, are divided into two groups so far as concerns their legal and administrative situation. The first group is known as the Mines Kali Sainte-Thérèse and was formed in 1910 with French and what was then Alsatian capital. This group was reincorporated in 1919 as a French corporation. The second group consists of those mines operated or owned by German capital and are known as the "mines formerly under sequester." It is this group which has been purchased by the Government.

At present the Mines Kali Sainte-Thérèse can produce 2,000 tons daily, and in a short time they will be able to produce 2,500 tons. The "mines formerly under sequester" can produce 9,000 tons daily and may later reach 12,000 tons. This productive capacity is more than double the sales in 1923, in which about 1,600,000 tons were extracted from the basin.

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[23] Bur. For. Dom. Commerce Chem. Trade Bull. 28-E, June 6, 1924.

[24] Bur. For. Dom. Commerce Chem. Trade Bull. 45-E, Oct. 20, 1924.

[25] Report from United States Consul Chester W. Davis, Strasbourg, France, Oct. 24, 1924.

The use of potash for fertilizer is not as general in France as it is in Germany, the Netherlands, and the United States, although an extensive propaganda in its favor has been carried on among French farmers. Nevertheless, the French consumption has increased as shown in the following figures: 1921, pure K_2O, 54,474 tons; 1922, 66,287 tons; 1923, 80,928 tons.

The United States is the largest foreign buyer of Alsatian potash, having purchased during 1923 more than 80,000 tons of pure potash (K_2O) in the form of chlorides and 5,000 tons of sulphate. Satisfaction is expressed in France about the German-Alsatian potash agreement. The shipment of Alsatian potash to the United States forms an important item in the traffic of the port of Strasbourg and the Rhine. This route is preferred because of lower freight rates to the point of embarkation on trans-Atlantic steamers. Comparative freight rates per ton of sylvinite are cited as follows:

Destination	Transportation by cars of 15 tons each (francs)	Transportation by complete trains (francs)
Antwerp by the Rhine by way of Strasbourg	25.65	24.00
Dunkirk	38.05	34.05
Le Havre	41.60	36.90

Labor troubles.—Strikes have interfered to a certain extent with potash production in Alsace. A request for an advance in wages was refused, but an agreement was finally reached between representatives of the miners' union and the management of the potash mines on the following basis: (1) Recognition of the union; (2) observance of the 6 and 8 hour day; (3) no reprisals against strikers; (4) a new scale of wages to be drawn up.[26]

Potash deposits in southern France.[27]—In the Pyrenees district of southern France, at Castagnede, near Salies-de-Bearn, in a locality where traces of petroleum were recently discovered, potash deposits that are thought to be of considerable importance have been found. The layer of potash salts lies at a depth of 180 meters and is about 90 meters thick. Analysis of a sample from a boring at a depth of 213 meters, made by the Compredon Laboratory, at Nantes, showed 11.94 per cent of potassium chloride. The deposit is considered commercially workable, and plans for exploitation are already under way.

OTHER COUNTRIES

Australia.—At the seventeenth biennial congress of Australian commercial bodies, held at Adelaide, it was resolved that a potash survey of Australia should be undertaken by the Institute of Science and Industry, through the state committees of the institute.[28]

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[26] Mining Jour. (London), vol. 147, No. 4660, pp. 964, 967, Dec. 13, 1924.

[27] Chem. and Met. Eng., vol. 32, No. 4, p. 158, Jan. 26, 1925; Am. Fertilizer, vol. 62, No. 3, p. 64, Feb. 7, 1925.

[28] Am. Fertilizer, vol. 61, No. 11, p. 33, Nov. 29, 1924.

Canada.[29]—At Malagash, in Nova Scotia, salt deposits have been developed within recent years. Potassium chloride occurs in a lenticular deposit in the form of crystalline masses of pink and yellowish-green sylvite in a matrix of halite. Potash zones have been penetrated at two points 30 feet apart and range in thickness from a few inches to 5 feet. The potash content is variable; in the zone near the top of the salt bed a 4-foot seam yielding an analysis of 1.16 per cent of potash was encountered; and about 30 feet lower stratigraphically a much richer potash zone was exposed, a full shot from the face in one place running 8.73 per cent of potash. Although it would seem at present unlikely that the Malagash deposits themselves will become an economic source of potash, other beds may be found in that region which will have enough for commercial purposes. Potash is also reported to occur between Weyburn and Halbrite, in Saskatchewan, on the Canadian Pacific Railway; here efflorescences of white salts appear on the surface of the ground, but the presence of soluble salts in the drift does not necessarily mean that similar salts will be found in commercial quantities in the strata beneath. Potash is reported from the northeastern part of Saskatchewan, and the water at Quill Lake, at Wynyard, contains an appreciable amount of potassium chloride.

The high potash content of numerous deposits of feldspar in eastern Canada may some day become a source of supply, if the problem of commercial recovery of potash from silicates can be technically and economically solved.

Chile.[30]—In the April issue of Caliche, the official organ of the Instituto Científico é Industrial del Salitre, an interesting account is given of investigations recently carried out at the plant of the Liverpool Nitrate Co. (Ltd.), at Mapocho, Chile. It has been demonstrated that a maximum yield of potash is achieved during treatment of the raw material by using liquids at the highest possible density and temperature. In accordance with the methods of hot leaching that are successfully practiced at the Du Pont Delaware plant, external heating of the solutions and finer grinding of the caliche resulted satisfactorily; high densities and temperatures, with slime-free solutions, were obtainable, with insignificant evaporation, the net result being an increased extraction of potash as well as of nitrate. An interesting development was the saving in fuel needed as compared with that required by the Shanks machine, estimated at 25 per cent. Furthermore, owing to the more efficient displacement of solutions, the amount of water needed was so much less that with caliche of 20 per cent grade no external evaporation was necessary.

Czechoslovakia.[31]—According to press notices a price agreement has been concluded between French and German potash producers regarding the sale of 15,500 to 20,000 tons of potash to purchasers in Czechoslovakia, who are free to choose between French and German products. As early as November, 1924, the German press announced a similar agreement, but the report was denied later.

Italy.[32]—The Vulcania Co., founded in 1923, has acquired extensive beds of leucite in the volcanic area of Monte Cimino, about

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[29] Potash situation in Canada (1922), Canadian Pacific Ry. Co., Montreal.

[30] Chem. and Met. Eng., vol. 31, No. 6, p. 215, Aug. 11, 1924.

[31] Dumont, F. T. F., United States consul, Frankfort-on-the-Main, Germany, report dated Jan. 15, 1925.

[32] Potash from leucite in Italy: Am. Fertilizer, vol. 62, No. 10, p. 58, May 16, 1925.

40 miles north of Rome. For the separation of potash contained in this leucite it has erected works that can handle 60,000 tons of rock a year and is now building a factory with an initial annual output of 3,000 tons of nitrate of potash, obtained by a process patented by Antonio Meerschmit. This process consists in heating the pulverized leucite rock, mixed with a solution of sodium salt, to 200° C., thus converting it into a silicate of aluminum and of sodium, while all the potash enters into solution as a nitrate. When the concentrated solution cools, about 90 per cent of the nitrate of potash content separates in crystals; the liquid solution, to which a further quantity of sodium nitrate and crushed leucite is added, is again subjected to the process. Valuable fertilizers can be obtained by mixing potassic phosphates with the nitrate of potash thus produced.

Another process for utilizing leucite rock is that patented, after long years of experimental work, by Gian Alberto Blanc and used by the Società Italiana Potassa, which has erected works in the Province of Caserta to utilize the leucite lava of Roccamonfina. The ever-growing importance of aluminum to metallurgy and electrotechnology makes it a matter of great importance for Italy to produce this metal from leucite, which is a metasilicate of alumina and potash. Doctor Blanc's process makes it possible to split leucite into its three constituents—alumina, potash, and silica—all three in serviceable form. The alumina, indeed, is obtained so free from iron and silica that it can be used without further treatment for the manufacture of aluminum. The leucite is enriched by a new system of separation based on the magnetic properties of the particles of lava gangue which must be eliminated. With this end in view the leucite rock is reduced to a sand consisting of fragments of nonmagnetic leucite crystals and of magnetic basaltic gangue. This sand is submitted to a process under which it yields leucite granules containing 18 per cent of K_2O, 23 per cent of Al_2O_3, and 55 per cent of SiO_2. These granules are then [illegible] (4) a strong solutions of hydrochloric or nitric acid, and at the end of the process the products are pure chloride of potash, hydrate of aluminum practically free from iron and silicates and readily soluble in sulphuric acid for the production of sulphate of aluminum, and pure silicate suited to several important industrial uses.

Netherlands.—A new company[33] by the name of N. V. Kali Syndikaat, with a capital of 100,000 florins (100 shares of 1,000 florins par), has been started in the Netherlands by representatives of the German potash syndicate and of Maximilian Klempner, Berlin. Of the capital 50,000 florins is paid and 50,000 florins is covered by the plant and real estate in the Onstwedde Stadskanaal belonging to the German syndicate. According to the statutes of the company its purpose is the "mining of potash and sale of potash and other fertilizers and by-products, as well as the running of mines and factories," but it is thought that it will be a holding company for the potash syndicate's foreign interests, a rather important matter.

Norway.—Deposits of a potash mineral, presumably carnallite, have been discovered in the Province of Sondre Trondhjem, Norway.

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[33] Dumont, F. T. F., United States consul, Frankfort-on-the-Main, Germany, report dated Jan. 15, 1925.

The mineral beds are reported to be extensive and to average around 14 per cent K_2O.[34] (See also Sweden.)

Palestine.—According to an Associated Press report from Jerusalem, dated September 26, 1924, recent investigations indicate that the Dead Sea water contains potash, which, by a simple process, can be extracted at an expense of \$5 a ton. Including transportation charges and governmental tax the product can be delivered at the port of Haifa at a cost of \$15 a ton.

Poland.—The production of potash salts in Galician Poland during the first six months of 1924 was greater than during the corresponding period of any previous year, according to statistics compiled by the Polish Ministry of Commerce.[35] The output of 81,000 tons for 1924 was 32 per cent more than during 1923 and almost 35 times the output in 1913.

In 1923, according to the Polish Bureau of Monopolies,[36] Poland produced 61,503 tons of potash salts, of which 22,128 tons was kainite and the remainder sylvinite.

Russia.[37]—Russian potash salts have been described in a number of reports, but without important results. There are, however, potash deposits in the Ural district that have not hitherto been investigated. Such salts have been found in Novobagatinsk, Akat-Kul, Satep Addi, Dossor, Iskine, and Kara Tchungule. The quantity of chloride of potash, according to analyses by Ya V. Samoilof, ranges in general from 2 to 4 per cent, but exceptionally, as at Akat-Kul, it rises to 5.5 per cent. The content of magnesia and sulphuric acid is insignificant, so that the deposits of the Ural districts are analogous to the sylvinite deposits of Solikam.

Potash has also been found in the brine of Indersk Lake. Analysis of this brine by I. Ph. Schroder showed 26.59 per cent total salts, including 19[illegible] per cent NaCl, 4.57 per cent $MgCl_4$, 1.74 per cent KCl, 0.36 [illegible] cent $MgSO_4$, and 0.33 per cent $CaSO_4$. The specific [illegible] that are [illegible] salts of the Ural district have been investigated only extern[illegible] samples found at random. The necessity of further geologic and chemical investigation, together with careful drilling, is pointed out.

Spain.—The potash deposits of Spain are, it seems, soon to come upon the market.[38] It is said that the Unión Española de Explosivos, successor to the Sociedad General de Industria y Comercio, after some drilling in the salt deposit of Cardona, acquired this property and will soon begin installing a plant for its exploitation. It is added that the Sociedad la Minera, the Fordina Co., and other concessionaires give indications of approaching activity.

The Minas Potásicas de Suria Co., a subsidiary of the Solvay Co., has already made substantial progress on a comprehensive plan of development. A shaft 20 feet in diameter has been sunk 1,220 feet, and at the bottom is a hopper designed to hold 3,000 tons of mineral. The preparatory work already done includes a number of galleries driven at different levels, communicating by means of inclines. The sections cut in the mineral confirm the previously announced richness of the deposit, which consists of sylvite and carnallite. An important electrical installation has been completed, large iron surface buildings are now being put up, and the scale of the developments in general is based on an intended production of several thousand tons a day. The building for the treatment of sylvite is already complete. A railroad 8.7 miles long with a 1-meter gauge and with bridges and tunnels has been built from Suria to Manresa. At Barcelona, whence the potash will be shipped, an imposing quay has been constructed. Workmen already engaged in different departments of the project number about 600.

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[34] Oil, Paint, and Drug Reporter, vol. 106, No. 24, p. 64, Dec. 1, 1924.

[35] Bur. For. Dom. Commerce Chem. Trade Bull. 48-E, Oct. 8, 1924.

[36] Ind. and Eng. Chemistry, vol. 16, No. 5, p. 526, May, 1924.

[37] Russian research for potash in the Ural: Am. Fertilizer, vol. 62, No. 10, pp. 34-36, May 16, 1925.

[38] Spanish potash coming on the market: Am. Fertilizer, vol. 62, No. 1, pp. 35, 36, Jan. 10, 1925.

Sweden.—Swedish producers of caustic potash and potash lye complain that Germany has been dumping such commodities in their home market. According to the Svenska Dagbladet, the Swedes are being crowded out of their natural sales district by Germans, who quote much lower prices than those prevailing in neighboring countries. This complaint is supported by facts, for until a few years ago the German price for potash lye in Sweden was 27 krone, whereas now it is only 16.90 krone. Swedish manufacturers have tried to reach an agreement with German producers by offering them 30 per cent of the Swedish quota, but the Germans refuse to consider this proposition. Their reason for so doing is that their policy can not be termed dumping, as they are merely competing in a territory which, until a short time ago, they had always dominated.[39]

The first Swedish installation employing the Jungner process of manufacturing potash as a by-product in the manufacture of cement was recently put into operation. The Jungner patents are owned and controlled by Aktiebolaget Jungner-Kali (the Jungner Potash Co., Ltd.), Stockholm, Sweden.

The big cement plant at Slite, on the island of Gothland, is now using the process to great advantage. The product, which is obtained in the Cottrell-Möller apparatus, is an excellent potash fertilizer containing 34.27 per cent K_2O, of which 98.4 per cent is soluble in 4 per cent HCl, 95.9 per cent in 2 per cent HCl, and 89.6 per cent in water, all at room temperature.

Jungner potash is also manufactured at the Dalen Portland Cementfabrik, Norway. The raw materials are a potash-bearing granite and lime. The cement is here, as well as at Slite, of excellent quality, and a considerable amount of potash fertilizer is produced.[40]

SUMMARY OF WORLD PRODUCTION

In the following table, compiled by Miss W. I. Whiteside, are listed the countries which in the last few years have produced potash, together with the available figures for their production of crude salts. The countries here listed differ to some extent from those given in the table of imports (p. 32), because in that table some of the countries from which the imports came were not themselves producers but received their supply from other countries. In both tables, however, the predominance of Germany and Alsace as producers of potash is clearly shown.

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[39] Dumont, F. T. F., U. S. consul general, Frankfort-on-the-Main, Bur. For. Dom. Commerce Special Circ. 94, Apr. 21, 1925.

[40] Potash as a by-product in the manufacture of cement in Sweden: Am. Fertilizer, vol. 62, No. 7, p. 40, Apr. 4, 1925.

Although the figures for crude salts produced in France in 1924 are not available, the following quantities of salts of the grades given are reported: Sylvinite, 12–16 per cent, 355,299 metric tons; sylvinite, 20–22 per cent, 414,714 metric tons; sylvinite, 30–40 per cent, 118,187 metric tons; chloride, 171,693 metric tons.

World's production of potash minerals and content of K_2O, 1913, 1920–1924, in metric tons

Country and mineral	1913		1920		1921	
	Output	K_2O content	Output	K_2O content	Output	K_2O content
Abyssinia, chloride of potash	--------	--------	1,087	544	(a)	(a)
Australia:						
New South Wales, alunite	2,271	(a)	644	54	528	45
South Australia, alunite	--------	--------	20		15	
Austria (Galicia), kainite and sylvinite	2,344	(a)	(b)	(b)	(b)	(b)
Canada, natro-alunite	--------	--------	--------	--------	27	(a)
China [c]	--------	--------	542	(a)	608	(a)
France (Alsace), crude salts	(d)	(d)	1,221,925	194,355	884,140	144,836
Germany, crude salts	[d] 11,956,528	(e)	11,390,166	(a)	9,241,179	1,066,849
India, British:						
Nitrate of potash	14,694	(a)	17,145	6,858	16,149	6,460
Other salts	--------	--------	51	7	--------	--------
Italy:						
Alunite	5,976	(a)	3,445	368	1,171	125
Leucite	1,600	(a)	8,200	(a)	14,805	(a)
Japan, alunite	(a)	(a)	(a)	(a)	(a)	(a)
Poland:						
Kainite	(f)	(f)	2,300	230	182	18
Sylvinite	(f)	(f)	7,993	800	15,329	1,550
Spain, nitrate of potash	(a)	(a)	(a)	(a)	(a)	(a)
Unites States, crude salts	(g)	(g)	151,348	43,614	23,119	9,227

Country and mineral	1922		1923		1924	
	Output	K_2O content	Output	K_2O content	Output	K_2O content
Abyssinia, chloride of potash	(a)	(a)	(a)	(a)	(a)	(a)
Australia:						
New South Wales, alunite	188	23	1,014	82	(a)	(a)
South Australia, alunite	97		--------	--------	(a)	(a)
Austria (Galicia), kainite and sylvinite	(b)	(b)	(b)	(b)	(b)	(b)
Canada, natro-alunite	45	(a)	14	(a)	(a)	(a)
China [c]	493	(a)	479	(a)	(a)	(a)
France (Alsace), crude salts	1,326,859	211,675	[h] 1,568,000	248,528	(a)	271,624
Germany, crude salts	13,012,320	1,509,850	(a)	[i] 885,942	(a)	[i] 824,000
India, British:						
Nitrate of potash	11,673	4,744	8,692	3,542	(a)	(a)
Other salts	--------	--------	--------	--------	(a)	(a)
Italy:						
Alunite	--------	--------	135	(a)	(a)	(a)
Leucite	18,000	(a)	8,720	(a)	1,850	(a)
Japan, alunite	1,178	100	(a)	(a)	(a)	(a)
Poland:						
Kainite	2,520	15,479	22,128	29,404	81,000	(a)
Sylvinite	43,563		39,375			
Spain, nitrate of potash	(a)	(a)	76	51	(a)	(a)
United States, crude salts	22,839	10,627	35,406	18,339	39,661	20,771

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[a] Data not available.
[b] Included under Poland.
[c] Exports.
[d] Production of Alsace in 1913 included under Germany.
[e] For sales of pure potash (K_2O) see p. 48.
[f] Included under Austria.
[g] Figures not available; production unimportant.
[h] Reported as sylvinite, but believed to be crude salts
[i] Figures relate to sales.

RECENT PATENTS

The following patents on the recovery of potash from various sources have been issued recently:

UNITED STATES

Alexander, C. M., No. 1522091, January 6, 1925. Orthoclase or similar potassium-bearing minerals are pulverized and injected with fuel and air into a combustion and reaction chamber in order to obtain soluble potassium compounds. Steam is injected into the materials after they are highly heated.

Dolbear, C. E., No. 1496152, June 3, 1924. Salts (such as those of the brine of Searles Lake, Calif.), one at least of which does not increase in solubility with increase in temperature, are mixed with a relatively cold saturated solution of all the salts to be treated, the mixture is heated, and the hot solution is separated from the undissolved salts. The hot solution is cooled while quiescent to effect deposition of salts such as KCl and borax. The cooled solution separated from the precipitated salts is used as the saturated solution for repetition of the process with additional mixed salts.

Dolbear, C. E., No. 1496257, June 3, 1924. A mixture of residual salts from the brine of Searles Lake, Calif., or similar salt mixture which may contain chlorides, borates, carbonates, and sulphates of potassium and sodium, is leached to dissolve potassium chloride and borax—for example, by use of a saturated cold residue solution subsequently treated. The remaining salts are dissolved in H_2O, Na_2CO_3 is separated from the solution by use of CO_2 to precipitate $NaNCO_3$, and Na_2SO_4 is precipitated by use of NH_3.

Friend, R. O., Nos. 1522112 and 1522113, January 6, 1925. Describe process of treating glauconite or greensand.

Giordani, F., No. 1496264, June 3, 1924. After treating leucite rocks with HCl for the recovery of KCl the solution obtained is neutralized—for example, with KOH—and settling of silica is effected to remove it from the solution.

Halvorsen, B. F., Oslo, Norway, and others, assignors to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Oslo, No. 1531336, March 31, 1925. Leucite is dissolved in dilute nitric acid, and the solution is neutralized, evaporated, and cooled, so that mixed crystals of potassium nitrate and aluminum nitrate are precipitated.

LaRue, L. B., and Scofield, S. W., No. 1494029, May 13, 1924. Silicates such as amorphous (crushed and calcined) potash feldspar are converted into alkali metal silicate and aluminate by treatment with caustic alkali—for example, with a 90 per cent KOH solution at a temperature of about 275° to 325° with potash feldspar—and the solution is then treated with CO_2 under pressure without heating to produce K_2CO_3, $KHCO_3$, and $Al(OH)_3$. The $Al(OH)_3$ may be converted into alum.

Scofield, S. W. See LaRue, L. B.

Silsbee, J. L., No. 1505295, August 19, 1924. Natural brines and calcareous muds—for example, those of the western United States—after evaporation by solar heat are free from the $NaCl$ and KCl which separate. The mother liquor remaining, containing $MgCl_2$, is treated with MgO to form a solid mixture, which is then roasted to produce HCl and MgO. The HCl is used to treat a fluid mixture of mud and brine, thus producing CO_2, and the latter is used to treat an aqueous mixture of MgO and KCl and produce a double salt of potassium and magnesium carbonate and $MgCl_2$.

GREAT BRITAIN

Michael, J., & Co., No. 208114, July 27, 1923. KNO_3 is obtained by treating boiling K_2SO_4 solution with excess of $NaNO_3$ in solution. The Na_2SO_4 precipitated is removed while hot, and the mother liquor is cooled to 17° to yield KNO_3. K_2SO_4 and $NaNO_3$ are dissolved in the remaining liquor, and the cycle is continued. The Na_2SO_4 recovered contains a small quantity of K_2SO_4, which is removed by treatment with a saturated solution of Na_2SO_4.

NORWAY

Norsk Hydro-Elektrisk Kvaelstofaktieselskab, No. 39013, March 3, 1924. Easily decomposable potash-containing rocks are treated with HNO_3 of such a concentration that the reaction product will form a solid pulverizable mass.

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FLUORSPAR AND CRYOLITE

By Hubert W. Davis

FLUORSPAR

Fluorspar, or fluorite, is a nonmetallic crystalline mineral that usually occurs in glassy transparent cubes or cleavable masses. Less commonly it is granular or fibrous in structure, and occasionally is banded. Fluorspar has a specific gravity of 3.2, is brittle, has a hardness of 4, and can easily be scratched by a knife. Chemically it consists of calcium and fluorine in the proportion of 51.1 to 48.9. In color fluorspar ranges, according to purity, from a clear colorless, or slightly bluish, glasslike substance through various brilliant hues, of which purple and green are most common; much of it is white and opaque.

FLUORSPAR MINED AND SHIPPED

The shipments of fluorspar from domestic mines in 1924 amounted to 124,979 short tons, valued at $2,451,131, an increase of 3 per cent in quantity but a decrease of 2 per cent in total value as compared with 1923. The general average price per ton f. o. b. mines or shipping points for all grades in 1924 was $19.61, a decrease of $1.07 from the average in 1923. The highest average price in 1924 was reported from Illinois and the lowest in Colorado. Kentucky and Colorado were the only States that showed an increase in shipments in 1924. The shipments of fluxing grade fluorspar to steel plants and to foundries showed an increase of about 11 per cent in 1924, but the shipments of the higher grades of fluorspar recorded a decrease of about 28 per cent.

The exact quantity of crude fluorspar mined can not be ascertained, because at most of the smaller mines only the cleaned material is weighed. The total quantity of merchantable fluorspar recovered by mining and milling in 1924 decreased nearly 2 per cent from 1923.

Merchantable fluorspar recovered in the United States, 1923 and 1924, by States

State	1923			1924		
	Short tons	Percentage	Number of producers	Short tons	Percentage	Number of producers
Illinois	93,845	62.93	12	54,896	37.38	11
Kentucky	44,483	29.83	26	73,720	50.20	20
Colorado	6,252	4.19	6	15,195	10.35	12
New Mexico	4,438	2.98	6	2,887	1.97	7
New Hampshire	97	.07	1			
Utah				102	.07	1
Texas				48	.03	1
	149,115	100.00	51	146,848	100.00	52

Fluorspar produced [a] in the United States, 1880–1924

Year	Illinois		Kentucky		Other States		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1880–1901	([b])	([b])	([b])	([b])	([b])	([b])	178, 117	$1, 067, 655
1902–1917	986, 334	$6, 404, 498	[c] 310, 498	[c] $2, 336, 737	[c] 62, 575	[c] $482, 553	1, 359, 407	9, 223, 788
1918	132, 798	2, 887, 099	87, 604	2, 069, 185	43, 415	509, 197	263, 817	5, 465, 481
1919	92, 729	2, 430, 361	32, 386	883, 171	13, 175	212, 042	138, 290	3, 525, 574
1920	120, 299	3, 096, 767	46, 091	1, 246, 942	20, 388	374, 838	186, 778	4, 718, 547
1921	12, 477	315, 767	15, 266	294, 513	7, 217	113, 814	34, 960	724, 094
1922	83, 855	1, 493, 188	52, 484	970, 059	5, 257	67, 918	141, 596	2, 531, 165
1923	65, 045	1, 443, 490	45, 441	945, 402	10, 702	116, 927	121, 188	2, 505, 819
1924	62, 067	1, 288, 310	47, 847	988, 940	15, 065	173, 881	124, 979	2, 451, 131
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[a] Beginning with 1906 figures represent shipments from mines.
[b] Figures by States not available.
[c] Small quantity from Colorado and Tennessee included with Kentucky.

Such details of the shipments of fluorspar from 1921 to 1924, by States, as may be published without revealing, except by permission, the statistics of individual producers, are given in the following table:

Fluorspar shipped from mines in the United States, 1921–1924

State	Gravel			Lump			Ground			Total		
	Short tons	Value		Short tons	Value		Short tons	Value		Short tons	Value	
		Total	Average		Total	Average		Total	Average		Total	Average
1921												
Colorado	3,143	$39,907	$12.70							3,143	$39,907	$12.70
Illinois	8,208	146,746	17.88	1,099	$80,838	$21.39	3,170	$235,981	$40.00	12,477	315,767	25.31
Kentucky	11,714	185,451	15.83	1,689			1,863			15,266	294,513	19.29
New Mexico	1,650	21,450	13.00	991			866			3,507	60,186	17.16
New Hampshire	[a] 567	[a] 13,721	24.20	(a)	(a)					567	13,721	24.20
	[a] 25,282	[a] 407,275	16.11	[a] 3,779	[a] 80,838	21.39	5,899	235,981	40.00	34,960	724,094	20.71
1922												
Colorado	2,309	20,169	8.73							2,309	20,169	8.73
Illinois	76,537	1,243,151	16.24	1,722	96,033	18.57	5,596	368,649	36.42	83,855	1,493,188	17.81
Kentucky	45,680	774,086	16.95	2,629			4,175			52,484	970,059	18.48
New Mexico	1,008	12,320	12.22	820			352			2,180	30,992	14.22
New Hampshire and Utah	[a] 690	[a] 15,353	22.25	[a] 78	[a] 1,404	18.00				768	16,757	21.82
	[a] 126,224	[a] 2,065,079	16.36	[a] 5,249	[a] 97,437	18.56	10,123	368,649	36.42	141,596	2,531,165	17.88
1923												
Colorado	3,957	36,631	9.26	2,087	23,079	11.06				6,044	59,710	9.88
Illinois	52,249	1,013,927	19.41	5,659	232,846	26.37	7,137	398,118	36.86	65,045	1,443,490	22.19
Kentucky	39,394	756,701	19.21	2,432			3,615			45,441	945,402	20.81
New Mexico	3,540	38,161	10.78	738			50			4,328	50,861	11.75
New Hampshire				142	6,356	19.26				142	6,356	19.26
Utah				188						188		
	99,140	1,845,420	18.61	11,246	262,281	23.32	10,802	398,118	36.86	121,188	2,505,819	20.68
1924												
Colorado	11,986	130,791	10.91	315	4,620	14.67				12,301	135,411	11.01
Illinois	54,541	1,042,089	19.11	2,766	108,090	22.68	4,760	356,871	35.89	62,067	1,288,310	20.76
Kentucky	41,809	789,352	18.88	932			5,106			47,847	988,940	20.67
New Mexico	1,620	19,318	11.92	883			77			2,580	38,470	13.92
Utah				184						184		
	109,956	1,981,550	18.02	5,080	112,710	22.19	9,943	356,871	35.89	124,979	2,451,131	19.61

[a] Some lump fluorspar included with gravel.

FLUORSPAR INDUSTRY, BY STATES

Colorado.—The shipments in 1924 amounted to 12,301 short tons, an increase of 104 per cent over the shipments in 1923. The mineral was obtained from Cowdrey, Jackson County; Wagon Wheel Gap, Mineral County; Jamestown, Boulder County; Ouray, Ouray County; and in Custer County, near Cotopaxi. About 36 per cent of the shipments from Colorado in 1924 went to the steel plant of the Colorado Fuel & Iron Co., at Pueblo, Colo., and the greater part of the remainder was sold to steel plants in the Chicago, Ill., district.

Development work at the mine near Cowdrey went on continuously during 1924, and two levels were opened up for stoping. It is reported that a new vein, parallel to and 40 feet west of the old vein, was developed ready for stoping. A new tunnel was started at the south end of the claims to run directly under the old workings, giving a depth of 600 feet. New installations at this mine in 1924 included a pump plant, a pipe line from Pinkham Creek to the mill, a distance of 6,000 feet, three jigs with sizing trommels and a classifier, and a crusher.

The mine at Wagon Wheel Gap was acquired on July 15, 1924, by the Colorado Fuel & Iron Co., the largest consumer of fluorspar in the West, and the purchase will probably largely eliminate this company as a buyer of fluorspar.

Illinois.—The productive deposits of fluorspar in Illinois are in Hardin and Pope Counties, in the extreme southern part of the State. The principal mines are near Rosiclare, Elizabethtown, and Cave-in-Rock, small towns on the Ohio River, in Hardin County. The largest deposit yet discovered, known as the Rosiclare-Fairview vein, is in Hardin County and occurs in a fault fissure. The country rock is limestone and sandstone. The flourspar occurs in lenticular masses in the vein, which pinches laterally and vertically. At Cave-in-Rock fluorspar occurs in flat-lying tabular masses, locally called "blanket" formations. A detailed report on the southern Illinois district has been published by the Illinois Geological Survey.[1] This report describes the chief mines and prospects, discusses the mining and milling methods, and offers suggestions for prospecting. It contains topographic and geologic maps which show the location of the fluorspar mines.

The shipments of fluorspar from Illinois in 1924, 62,067 short tons, showed a decrease of 5 per cent from those in 1923. Labor conditions in the fluorspar field were satisfactory; there were no strikes and practically no changes in wages in 1924.

The Rosiclare Lead & Fluorspar Mining Co. obtained its output from its Daisy and Empire mines. The Empire mine was worked under lease from the Pierce Fluorspar Co. The Daisy mine is under active development at the 180-foot and 412-foot levels. Three new ore bodies were developed in 1924. The Rosiclare mine is flooded and according to reports will not be unwatered in 1925.

The mines and mill of the Fairview Fluorspar & Lead Co. were purchased on November 17, 1924, by the Franklin Fluorspar Co., a subsidiary of the Aluminum Co. of America. This company also acquired the Hamp mine, near Karbers Ridge.

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[1] Weller, Stuart, and others, The Geology of Hardin County: Illinois Geol. Survey Bull. 41, 1920.

The mines of the Hillside Fluor Spar Mines were slightly less active in 1924.

A small quantity of fluorspar was produced at the Du Bois mine, near Eichorn. A log washer was installed in 1924 and it is planned to sink two shafts during 1925 and to complete a jig mill.

Development work was continued at the Douglas property, in Pope County, and some fluorspar of fluxing grade was shipped.

Kentucky.—The fluorspar deposits thus far developed in western Kentucky are in Crittenden, Livingston, and Caldwell Counties, but the mines of Crittenden County include not only the largest producers but the largest number of productive veins. Commercial deposits of fluorspar also occur in central Kentucky, but no production has been reported during the past few years. A study of the fluorspar deposits of the western and central Kentucky districts has been made by Currier.[2]

The quantity of fluorspar shipped from Kentucky in 1924 amounted to 47,847 short tons, an increase of 5 per cent as compared with 1923. Labor conditions were satisfactory. It is reported that labor is better employed at higher average wages than at any previous time in this part of the fluorspar district.

The mines near Mexico, Ky., that are controlled by the Lafayette Fluorspar Co., a subsidiary of the United States Steel Corporation, were considerably developed during 1924, and a railroad was built from Mexico to the mines. Extensive plans were made for a modern mill, a power plant, and other buildings. Erection started in November and was to be completed in the early part of 1925. Road improvements were made around the mines, and construction of a narrow-gauge railroad between the four operating mine shafts on the property was begun. This company has taken over the properties of the Big Four Fluorspar & Ore Co., about 8 miles from Marion, Ky. The Big Four is considered to be one of the best fluorspar mines in Kentucky, although it is only partly developed.

All of the properties of the Kentucky Minerals Holding Co. were sold the latter part of 1924 to the Franklin Fluorspar Co., a subsidiary of the Aluminum Co. of America. These include the Susie Beeler, near Crayne, and the Beard, Mary Belle, Brown, Ada Florence, Union, and Ben Mack mines near Marion, which were operated under lease to the Kentucky Fluorspar Co. The Franklin Fluorspar Co. has also purchased the Franklin and Hoover mines, near Marion, and it owns the Haffaw mine, at Mexico, and the Memphis mine, near Marion.

At the Macer mine, near Marion, on the La Rue vein, development work continued during part of 1924, and it is reported that this mine will soon reach the productive stage.

Trommel washers, a picking belt, classification bins, and a new power plant were installed at the Blue and Marble mine, at Mexico, Ky. It is reported that four shafts are ready for operation, including a cross cut to the vein at the 300-foot level from Shaft No. 1, which will become the main working level across the property.

The fluorspar property of about 60 acres, known as the Keystone mine, about 6 miles from Marion, was purchased in 1924 by the Hillside Fluor Spar Mines, which expects to develop the property during 1925. The company already has two producing mines and a modern fluorspar mill at Rosiclare, Ill.

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[2] Currier, L. W., Fluorspar deposits of Kentucky: Kentucky Geol. Survey, 6th ser., vol. 13, 1923.

The Davenport mine, near Salem, Ky., made its initial production in May, 1924. A log washer was installed during the year.

The Roberts Fluorspar Co., operating a mill at Marion at which grinding equipment was installed in 1923, reported good sales of ground fluorspar. This company was succeeded on December 15 by the Kentucky Fluorspar Co., a continuation in name only of the old Kentucky Fluorspar Co.

At the Klondyke mine, near Smithland, Livingston County, a modern mill was reported completed the latter part of 1924, and the owners report that the mine was developed to a capacity of 40 tons a day.

New Mexico.—The shipments of fluorspar from New Mexico in 1924 amounted to 2,580 short tons, a decrease of 40 per cent from those in 1923. Some of this mineral was shipped to steel plants in the West, but the greater part went to eastern consumers.

The Tortugas mine, at Mesilla Park, Dona Ana County, was the largest producer in New Mexico in 1924. It is reported that the main shaft has been sunk 291 feet, at which depth the ore is said to be about 6 feet wide.

A small quantity of fluorspar was mined from claims about 15 miles from Separ, in Grant County. No one property was developed or equipped to make regular shipments, but it is said that considerable fluorspar can be produced in a year.

A few carloads of fluorspar were shipped from the Caballos Mountains district and some was shipped from the Nakaye mine, near Derry.

Texas.—What is believed to be the first production of fluorspar in the State of Texas was made in 1924 from a prospect about 7 miles from Hot Wells, Hudspeth County. No fluorspar was shipped in 1924. The fluorspar is reported to contain 88.4 per cent of calcium fluoride and 7.8 per cent of silica.

Utah.—A small production was reported from the Silver Queen mine, near Clive, Tooele County, most of which was shipped to steel plants. A small shipment to be used for test work in lead refining was reported.

STOCKS OF FLUORSPAR

According to the reports of producers the total quantity of fluorspar in stock at the mines or at shipping points at the end of 1924 amounted to 69,580 short tons, an increase of 45 per cent over 1923. These stocks consisted of about 29,200 tons of crude fluorspar (which must be milled before it can be marketed), 32,700 tons of gravel fluorspar, 6,600 tons of lump fluorspar, and 1,100 tons of ground fluorspar. As the quantity of fluorspar in stock piles must be partly estimated, there are variations in the mine reports from year to year that prevent an absolute balance between the quantity mined and the quantity shipped and in stock. Indeed, when the stocks on hand in Illinois at the end of 1923 were shipped they proved to have been considerably overestimated. In the following table the figures that represent stocks in Illinois for 1923 have been adjusted accordingly. The stock at the end of 1924 amounted to 56 per cent of the total quantity shipped from the mines in 1924, and represented a rather high ratio to the total output of fluorspar. Data on consumers' stocks, noted under consumption (p. 71), which show large stocks, indicate so large a surplus that a decided curtailment in output may be expected in 1925.

Stocks of fluorspar at mines or shipping points in the United States, 1923–24, by States, in short tons

State	1923	1924
Arizona	400	400
Colorado	1,480	4,374
Illinois	[a] 38,971	30,662
Kentucky	6,387	33,101
Nevada	530	530
New Mexico	160	465
Texas		48
Utah	82	
	[a] 48,010	69,580

[a] Revised figures.

IMPORTS AND EXPORTS [3]

The total imports of fluorspar into the United States in 1924 amounted to 51,043 short tons and were the largest ever recorded. The next largest total on record was in 1910, when 42,488 tons were imported. The imports in 1924 showed an increase of 21 per cent in quantity and 29 per cent in value over those of 1923. The value at the foreign mines averaged $10.89 a ton. The cost to the consumers in the United States includes, in addition to the duty of $5 a ton, the cost of transporting the fluorspar from the mines to the docks, loading charges at the docks, the ocean freight charges, and other small charges, besides the freight charges from the docks to manufacturers' plants.

The imports were equivalent to about 41 per cent of the domestic shipments of fluorspar, as compared with about 35 per cent in 1923.

England continues to be the chief source of imported fluorspar, supplying four-sevenths of the total in 1924. Most of the English fluorspar is of fluxing grade and the cost to the consumers in the United States is reported to have ranged between $16.75 and $20 a short ton, duty paid, at tidewater for material containing 85 per cent of calcium fluoride and 5 per cent of silica. According to reports of importers of 17,500 tons of English fluorspar, the selling price of this quantity at tidewater, duty paid, averaged $18.09 a short ton in 1924.

The imports of German fluorspar showed a decrease of 20 per cent in quantity in 1924. Some high-grade fluorspar is being imported from Germany. According to reports of importers of 6,600 tons of German fluorspar, the selling price of this quantity in the United States in 1924 ranged between $17 and $27 a short ton, duty paid, at tidewater, and averaged $19.25.

The class rate on fluorspar from Baltimore, Md., to Pittsburgh, Pa., is $4.29 a short ton ($4.80 a long ton). There is a commodity rate on fluorspar, however, from Philadelphia to Pittsburgh of $3.02 a long ton (about $2.70 a short ton). As the freight rate on fluorspar from the Illinois-Kentucky district is $5.25 a long ton, or about $4.69 a short ton, the sellers of foreign fluorspar have an advantage over the domestic sellers.

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[3] The statistics of imports were compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce; those of exports were supplied by the producers. No exports of fluorspar are recorded by the Bureau of Foreign and Domestic Commerce.

More than one-fifth of the 1924 imports came from British South Africa. All of the fluorspar from this source is of "acid" grade and is used in the manufacture of hydrofluoric acid. The imports from Italy increased from 268 tons in 1923 to 1,585 tons in 1924. Most if not all of this fluorspar was of fluxing grade and the cost to consumers was about $18 a short ton, duty paid, at tidewater.

By the tariff act of 1922 the import duty on fluorspar was increased from $1.50 a long ton ($1.34 a short ton) to $5.60 a long ton ($5 a short ton).

The distances that domestic fluorspar must be transported by rail from mines to steel plants in the Lehigh and Susquehanna Valleys of Pennsylvania are generally much greater than the distances that foreign fluorspar must be moved from the ports of entry to these plants; moreover, a large part of the imported material is carried as ballast, making possible a lower market price than would have to be charged if it were carried as a primary cargo. Except when ocean freight rates are moderate, however, foreign fluorspar is not in a position to enjoy much advantage in American markets, for the reason that it is not generally of so high a grade as the mechanically cleaned domestic product. As fluorspar is of value chiefly according to its purity, purchasers should compare the American fluorspar with foreign fluorspar not on the basis of price per ton but on metallurgical efficiency.

Producers of fluorspar reported exports in 1924 amounting to 617 short tons, valued at $14,489, or $23.48 a ton, as compared with 1,144 tons, valued at $25,312, or $22.13 a ton, in 1923. All the exported fluorspar went to Canada.

Fluorspar imported into the United States, 1923–24, by countries

[General imports]

Country	1923			1924		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Africa:						
British South	10, 380	$157, 625	$15. 19	10, 585	$134, 959	$12. 75
Portuguese				540	13, 018	24. 11
Belgium	35	712	20. 34	6	75	12. 50
Canada	(a)	5		213	3, 216	15. 10
China	90	1, 183	13. 14	506	5, 089	10. 06
England	22, 862	202, 548	8. 86	29, 089	296, 662	10. 20
France				232	2, 782	11. 99
Germany	8, 580	67, 595	7. 88	6, 834	69, 357	10. 15
Italy	268	2, 471	9. 22	1, 585	14, 804	9. 34
Netherlands	11	180	16. 36	1, 177	13, 951	11. 85
Scotland				276	1, 729	6. 26
	42, 226	432, 319	10. 24	51, 043	555, 642	10. 89

[a] Quantity not recorded.

CONSUMPTION AND USES

The market for the bulk of fluorspar sold in the United States depends on the condition of the steel industry, and the demand fluctuates with the rise and fall in the production of basic open-hearth steel. From 80 to 85 per cent of the fluorspar produced in the United States is used as a flux in basic open-hearth steel furnaces. For this purpose steel makers require that the fluorspar be in pieces not larger than three-quarters inch and that it show on analysis at least 80 per cent (preferably more) calcium fluoride and not more than 6 per cent silica. This flux is used chiefly for giving fluidity to slags, but it also facilitates the passage of impurities such as sulphur and phosphorus into the slag.

Fluorspar is also used extensively in the manufacture of ceramic products, such as enameled and sanitary ware, opalescent glass, facing for bricks, and vitriolite, and in the manufacture of hydrofluoric acid. For ceramic products and glass manufacture a ground fluorspar analyzing 92 to 98 per cent calcium fluoride and from 1 to 4 per cent silica is demanded. For the manufacture of hydrofluoric acid fluorspar is sold either in lump form or pulverized and is usually guaranteed to contain not less than 98 per cent calcium fluoride and not over 1 per cent silica. In the manufacture of hydrofluoric acid fluorspar is treated with sulphuric acid, and the presence of impurities such as calcium carbonate and silica, is very detrimental. Calcium carbonate neutralizes sulphuric acid, and its presence to the extent of 1 per cent or more causes considerable foaming on mixing. Silica, if present, forms hydrofluosilicic acid in such proportion that for every part of silica nearly four parts of fluorspar and more than five parts of sulphuric acid of 66° B. are wasted, because for practically all applications of hydrofluoric acid the content of hydrofluosilicic acid is useless. Thus for 1 per cent of silica, 10 per cent should be deducted from the value of the fluorspar,[4] and so on.

Fluorspar also finds use as a flux in some blast-furnace operations and in iron and brass furnaces; in the smelting of gold, silver, and copper ores; in the refining of copper, antimony, and lead; in carbon electrodes; in the manufacture of sodium fluoride used as a wood preservative and insecticide; and in connection with the extraction of potash from feldspar and from flue dust of Portland cement works.

Data furnished by steel manufacturers who produced 28,746,260 long tons of basic open-hearth steel in 1924, or 94 per cent of the total made by all steel manufacturers, show that they consumed 111,419 short tons of fluorspar in 1924 and had stocks on hand amounting to 60,207 short tons on January 1, 1925. If the few steel companies from whom no reports were received consumed a like proportion of fluorspar, the figures given indicate a total consumption in all steel plants of about 119,800 tons and total stocks of about 64,000 tons on January 1, 1925. Similar information indicated a consumption of about 140,000 tons (revised) for all plants in 1923 and stocks of about 49,900 tons on January 1, 1924.

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[4] Information according to J. E. Foster, General Chemical Co., published in Illinois Geol. Survey Bull. 41, 1920.

Estimated consumption and stocks of fluorspar at basic open-hearth steel plants, 1920–1924

	1920	1921	1922	1923	1924
Production of basic open-hearth steel____long tons__	31,375,723	15,082,564	28,387,171	34,665,021	30,719,523
Consumption of fluorspar in basic open-hearth steel production (estimate)____short tons__	[a] 125,500	[a] 61,800	[a] 105,000	[a] 140,000	119,800
Consumption of fluorspar per ton of steel made____pounds__	8.0	8.2	7.4	8.1	7.8
Stocks of fluorspar on hand at steel plants at end of year (estimate)____short tons__	66,600	30,000	65,000	49,900	64,000

[a] Revised figures.

The consumption of fluorspar per ton of steel made varies widely from year to year. That for 1924 ranged from a low of 3.3 pounds to a high of 24.9 pounds and averaged 7.8 pounds; the range in 1923 was from 4.5 to 24.2 pounds and averaged 8.1 pounds. Comparison of the reports furnished by certain manufacturers who make about 70 per cent of the total steel produced shows that the average consumption of fluorspar per ton of steel made will vary considerably from year to year, as illustrated by the figures in the following table:

Average consumption of fluorspar per ton of steel, 1921–1924, in pounds

1921	1922	1923	1924
18.644	18.476	16.176	19.295
4.843	7.113	8.973	7.409
7.633	6.552	6.416	6.857
9.578	8.804	7.780	5.365
7.086	5.308	5.799	5.383
9.224	7.051	6.475	7.652
11.578	9.331	9.880	8.747

CONSUMERS OF FLUORSPAR

The consumers of fluorspar include manufacturers of iron, aluminum, steel, brass, and other metals and alloys, metal products, chemicals, glassware, enameled ware, and Portland cement. Some of these users buy fluorspar direct from the producers, but most of it is handled through established brokers. The following list contains the names of manufacturers who purchase more than 95 per cent of the fluorspar used in the basic open-hearth steel industry. The complete list of purchasers for other uses is not known.

Consumers of fluorspar in the basic open-hearth steel industry

Name of manufacturer	Office address
Alan Wood Iron & Steel Co	Philadelphia, Pa.
Alleghany Steel Co	Brackenridge, Pa.
American Rolling Mill Co	Middletown, Ohio.
Andrews Steel Co	Newport, Ky.
Atlantic Steel Co	Atlanta, Ga.
Bethlehem Steel Co	Bethlehem, Pa.
Bourne Fuller Co	Cleveland, Ohio.
Central Iron & Steel Co	Harrisburg, Pa.
Central Steel Co	Massillon, Ohio.

Name of manufacturer	Office address
Colorado Fuel & Iron Co	Denver, Colo.
Cromwell Steel Co	Cleveland, Ohio.
Crucible Steel Co. of America	Pittsburgh, Pa.
Donner Steel Co	Buffalo, N. Y.
Eastern Steel Co	Pottsville, Pa.
Follansbee Brothers Co	Pittsburgh, Pa.
Gulf States Steel Co	Birmingham, Ala.
Inland Steel Co	Chicago, Ill.
Interstate Iron & Steel Co	Chicago, Ill.
Jones & Laughlin Steel Co	Pittsburgh, Pa.
Keystone Steel & Wire Co	Peoria, Ill.
Kokomo Steel & Wire Co	Kokomo, Ind.
Laclede Steel Co	St. Louis, Mo.
Lukens Steel Co	Coatesville, Pa.
Mansfield Sheet & Tin Plate Co	Mansfield, Ohio.
McKinney Steel Co	Cleveland, Ohio.
National Enameling & Stamping Co	Granite City, Ill.
Pacific Coast Steel Co	San Francisco, Calif.
Penn Seaboard Steel Corporation	Philadelphia, Pa.
Phoenix Steel Co	Phoenixville, Pa.
Pittsburgh Crucible Steel Co	Pittsburgh, Pa.
Pittsburgh Steel Co	Pittsburgh, Pa.
Republic Iron & Steel Co	Youngstown, Ohio.
Scullin Steel Co	St. Louis, Mo.
Sharon Steel Hoop Co	Sharon, Pa.
Trumbull Steel Co	Warren, Ohio.
United Alloy Steel Corporation	Canton, Ohio.
United States Steel Corporation	New York, N. Y.
Weirton Steel Co	Weirton, W. Va.
West Penn Steel Co	Brackenridge, Pa.
Wheeling Steel Corporation	Wheeling, W. Va.
Wickwire Spencer Steel Corporation	Buffalo, N. Y.
Youngstown Sheet & Tube Co	Youngstown, Ohio.

SHIPMENTS, BY USES

The great dependence of the fluorspar industry on the steel industry is shown by the fact that by far the greater part of the fluorspar shipped is taken by steel manufacturers. There is considerable variation in the average value per ton of the fluorspar shipped to the several industries. The high value of fluorspar for hydrofluoric acid and glass and enameled ware is due to the high quality demanded.

Fluorspar shipped from mines in the United States, 1923–24, by uses

Use	1923				1924			
	Percentage	Short tons	Value		Percentage	Short tons	Value	
			Total	Average			Total	Average
Steel	79.80	96,713	$1,762,602	$18.23	83.49	104,349	$1,849,073	$17.72
Foundry	3.09	3,748	79,452	21.20	5.71	7,138	159,533	22.35
Glass and enamel ware	8.89	10,768	389,515	36.17	7.65	9,565	335,243	35.05
Hydrofluoric acid (including fluorspar used in manufacture of aluminum and refining of lead)	5.76	6,976	210,596	30.19	2.52	3,150	89,413	28.39
Miscellaneous	1.52	1,839	38,342	20.85	.13	160	3,380	21.13
	99.06	120,044	2,480,507	20.66	99.50	124,362	2,436,642	19.59
Exported to Canada	.94	1,144	25,312	22.13	.50	617	14,489	23.48
	100.00	121,188	2,505,819	20.68	100.00	124,979	2,451,131	19.61

PRODUCTION, BY COUNTRIES

Fluorspar produced by countries, 1920–1924, in metric tons

Country	1920	1921	1922	1923	1924
Australia:					
New South Wales	1,213	----------	----------	----------	(a)
Queensland	613	545	----------	----------	1,894
Victoria	13	199	----------	----------	----------
Canada	10,192	5,025	4,085	126	5
France	8,997	5,776	9,251	(a)	(a)
Germany:					
Bavaria	6,272	7,210	13,221	10,543	(a)
Saxony	2,918	4,763	5,493	(a)	(a)
Prussia	7,339	11,989	8,630	10,810	(a)
Great Britain	55,561	23,508	33,343	49,818	(a)
Italy	810	1,600	1,395	3,362	6,831
Japan	(a)	(a)	36	(a)	(a)
Spain	416	176	392	----------	634
United States	169,441	31,715	128,453	109,939	113,378

[a] Figures not available.

CRYOLITE

Cryolite occurs in commercial quantities and is mined only in Greenland, at Ivigtut. Formerly two-thirds of the product was sold to the Pennsylvania Salt Co. and the other third went to Copenhagen, but at present these relative proportions are reversed. Of the cryolite shipped to the United States the greater part is now used as a flux in the metallurgy of aluminum and for making opaque glass. In aluminum metallurgy in this country the mineral is being supplanted by artificial cryolite.

The imports of cryolite into the United States in 1924, according to the Bureau of Foreign and Domestic Commerce, amounted to 6,320 long tons, valued at $320,670, or $50.74 a ton, as compared with 6,375 long tons, valued at $319,959, or $50.19 a ton, in 1923.

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PHOSPHATE ROCK

By George Rogers Mansfield[1]

INTRODUCTION

The phosphate-rock mining industry, which in 1923 showed notable advance over the two preceding years, suffered a moderate decline in 1924; thus hopes for general improvement in the phosphate business, which seemed bright at the beginning of the year, were not realized. Production in both Florida and Tennessee as a whole declined, but Tennessee blue rock and the Western States made noteworthy gains.

Export business fell off slightly, the loss being chiefly in Florida hard rock, but there was a marked increase in exports of Florida land pebble and other phosphates.

Efforts are being continued to induce farmers throughout the country to produce larger and better crops per acre rather than to enlarge their acreage. It seems certain, therefore, that the fertilizer industry and the phosphate-rock industry on which it depends must advance consistently.

PHOSPHATE ROCK SOLD

In 1924, the sales of phosphate rock in the United States amounted to 2,867,789 long tons, a decrease of 138,917 tons, or 5 per cent, from 1923, but an increase over every other year since 1913, except 1920. The value of the rock sold decreased $1,323,966, or 11 per cent. The quantity sold in 1924 was 22,486 tons, or 0.8 per cent, greater than the quantity mined, the excess being supplied by stocks held over from the preceding year.

Phosphate rock, mined in the United States, sold in 1918–1924

Year	Long tons	Value	Year	Long tons	Value
1918	2, 490, 760	$8, 214, 463	1922	2, 417, 883	$10, 482, 846
1919	2, 271, 983	11, 591, 268	1923	3, 006, 706	11, 576, 049
1920	4, 103, 982	25, 079, 572	1924	2, 867, 789	10, 252, 083
1921	2, 064, 025	12, 270, 070			

In this report the unit of quantity used in referring to phosphate rock is the long ton (2,240 pounds), except as otherwise specified. The value of domestic material means the selling value f. o. b. mines, so far as that can be determined from the returns submitted by the respective companies. Some of the companies, however, ship their rock to drying plants before selling and others sell the rock f. o. b. foreign ports; therefore the figures given by these companies probably include an undetermined charge for transportation and are somewhat higher than the value at the mine.

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[1] The statistical data in the chapter, except those on imports and exports and production in foreign countries, were prepared by Miss K. W. Cottrell, the tables of imports and exports were compiled by J. A. Dorsey, and the table on foreign production by Miss L. M. Jones, all of the Bureau of Mines. This work was essentially completed under the auspices of the United States Geological Survey. Miss Leona Boardman of the Survey assisted in the preparation of parts of the manuscript, especially the lists of patents and the bibliography.

The sales of raw phosphate for direct application to the soil reached a maximum in 1919, as shown below. In 1921 there was a sharp break in this business, and since that year sales have been relatively low. In 1924 the quantity thus sold increased 36 per cent over that for 1923 but was only 18 per cent of the sales for 1919. The rock sold in 1924 came from six producers. Tennessee supplied 98 per cent of this material, but small quantities came from Florida and Wyoming.

Raw phosphate rock sold for direct application to the soil, 1918–1924, in long tons

1918	45, 294	1922	16, 029
1919	79, 189	1923	10, 548
1920	72, 801	1924	14, 320
1921	13, 503		

The phosphate rock sold to blast furnaces in 1924 was 36,636 tons. This quantity, furnished by 9 companies in Tennessee, 2 in Idaho, and 1 in Florida, was an increase of 10,105 tons, or 38 per cent. The quantity sold for the manufacture of phosphorus was 107,901 tons, a decrease of 106,790 tons, or 50 per cent. The quantity of phosphate rock sold as an ingredient for stock food was 2,938 tons, produced by 4 companies in Tennessee (see p. 95).

PHOSPHATE ROCK MINED

The quantity of rock mined in any year is not the same as the quantity sold, for the stock at the mines at the end of each year is variable. The quantity of rock mined in 1924 was 2,845,303 long tons, a decrease of 98,263 tons, or 3 per cent. There were decreases of 2 per cent in Florida and 12 per cent in Tennessee and Kentucky, but an increase of 18 per cent in the Western States.

Phosphate rock mined in the United States, 1923–24, by States, in long tons

State	1923	1924	Percentage of increase or decrease in 1924
Florida	2, 421, 571	2, 373, 530	−2
Tennessee and Kentucky	487, 420	431, 038	−12
Western States	34, 575	40, 735	+18
	2, 943, 566	2, 845, 303	−3

STOCKS

Precise measurement of stocks of phosphate rock in the hands of producers is difficult. The estimates of stocks on December 31, 1923, reported by producers amounted to 738,000 tons. By adding to this the quantity mined during 1924 and subtracting from the sum the sales during the year an estimate of 716,000 tons is obtained.

PRODUCTION BY STATES

In 1924 both the quantity and value of the phosphate rock sold in Florida, Tennessee, and Kentucky decreased, but sales in the Western States increased in both quantity and value. There was a slight general decline in average values.

Phosphate rock, mined in the United States, sold in 1923–24, by States

State	1923		1924	
	Long tons	Value	Long tons	Value
Florida:				
Hard rock	199,516	$1,071,675	143,115	$629,579
Land pebble	2,348,137	7,987,752	2,289,466	7,387,897
	2,547,653	9,059,427	2,432,581	8,017,476
Tennessee:				
Brown rock	[a] 427,799	2,335,262	[a] 375,260	1,958,272
Blue rock	919	5,647	21,378	81,766
	[a] 428,718	2,340,909	[a] 396,638	2,040,038
Western States [b]	30,335	175,713	38,570	194,569
Grand total	3,006,706	11,576,049	2,867,789	10,252,083

[a] Includes brown rock from Kentucky.

[b] 1923, Idaho and Wyoming; 1924, Idaho, Montana, and Wyoming.

FLORIDA

Florida, the leading State in the production of phosphate rock, sold 85 per cent of all the phosphate rock sold in the United States in 1924. The quantity decreased 5 per cent and the value 12 per cent.

In the hard-rock field, which is concerned mainly with export trade, the quantity sold decreased 28 per cent and the value 41 per cent.

Land pebble rock constituted 94 per cent of the entire Florida output. Conditions in the pebble field were much better than in the hard-rock field, but still were below normal. The quantity of pebble rock sold in 1924 decreased 2 per cent and the value 8 per cent.

Florida phosphate rock sold in 1916–1924

Year	Hard rock			Soft rock		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
1916	[a] 47,087	[a] $295,755	$5.26	([a])	([a])	$9.76
1917	[a] 18,608	[a] 159,366	5.93	([a])	([a])	12.40
1918	62,052	377,075	6.08	8,331	$147,103	17.66
1919	285,467	2,452,563	8.59	14,498	196,318	13.54
1920	400,249	4,525,191	11.31	13,953	190,551	13.66
1921	175,774	1,806,671	10.28	4,419	20,153	4.56
1922	188,084	1,308,201	6.96	446	3,500	7.85
1923	199,516	1,071,675	5.37			
1924	143,115	629,579	4.40			

[a] Soft rock included with hard rock.

Florida phosphate rock sold in 1916–1924—Continued

Year	Land pebble			Total		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
1916	1, 468, 758	$3, 874, 410	$2. 64	1, 515, 845	$4, 170, 165	$2. 75
1917	2, 003, 991	5, 305, 127	2. 65	2, 022, 599	5, 464, 493	2. 70
1918	1, 996, 847	5, 565, 928	2. 79	2, 067, 230	6, 090, 106	2. 95
1919	1, 360, 235	5, 149, 048	3. 79	1, 660, 200	7, 797, 929	4. 70
1920	2, 955, 182	14, 748, 620	4. 99	3, 369, 384	19, 464, 362	5. 78
1921	1, 599, 835	8, 604, 818	5. 38	1, 780, 028	10, 431, 642	5. 86
1922	1, 870, 063	7, 035, 821	3. 76	2, 058, 593	8, 347, 522	4. 05
1923	2, 348, 137	7, 987, 752	3. 40	2, 547, 653	9, 059, 427	3. 56
1924	2, 289, 466	7, 387, 897	3. 23	2, 432, 581	8, 017, 476	3. 30

Prices of pebble rock rise rapidly with increase in content of tricalcium phosphate (known in the trade as "B. P. L."—that is, bone phosphate of lime), as shown in the following table:

Prices of pebble phosphate per long ton, f. o. b. Florida [a]

76 to 77 per cent	$5. 50
75 per cent	5. 25
74 to 75 per cent	5. 00
70 per cent	$3. 30
68 per cent	3. 00

[a] Eng. and Min. Jour.-Press, Jan. 3, 1925, p. 36.

SOUTH CAROLINA

No mining or sales of phosphate rock were reported from South Carolina in 1923 and 1924. The sales for several preceding years had decreased from 60,823 tons in 1919 to 44,141 tons in 1920 and 1,500 tons in 1922, no sales being reported in 1921. The average values of the rock at the mines for the three years specified were $5.08, $8.32, and $5.50, respectively.

TENNESSEE AND KENTUCKY

The total amount of phosphate rock shipped from Tennessee and Kentucky in 1924 decreased 7 per cent; the value decreased 13 per cent. The figures for Kentucky are not shown separately because there was but one operator. The sales of blue rock were more than 23 times the quantity and more than 14 times the value of those in 1923, but the average value decreased to $3.82, or 38 per cent.

Tennessee phosphate rock sold in 1916–1924 [a]

Year	Brown rock [a]			Blue rock			Total [a]		
	Long tons	Value at mines		Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average		Total	Average
1916	364, 108	$1, 357, 888	$3. 73	47, 682	$152, 465	$3. 20	411, 790	$1, 510, 353	$3. 67
1917	447, 203	1, 920, 533	4. 29	65, 904	205, 820	3. 12	513, 107	2, 126, 353	4. 14
1918	[b]374, 535	[b]1, 917, 546	5. 12	([b])	([b])	([b])	374, 535	1, 917, 546	5. 12
1919	475, 475	3, 123, 565	6. 57	58, 550	290, 951	4. 97	534, 025	3, 414, 516	6. 39
1920	556, 177	4, 425, 761	7. 96	78, 671	518, 234	6. 59	634, 848	4, 943, 995	7. 79
1921	252, 543	1, 666, 358	6. 60	25, 163	146, 198	5. 81	277, 706	1, 812, 556	6. 53
1922	344, 231	2, 055, 579	5. 97	9, 078	51, 803	5. 71	353, 309	2, 107, 382	5. 96
1923	427, 799	2, 335, 262	5. 46	919	5, 647	6. 14	428, 718	2, 340, 909	5. 46
1924	375, 260	1, 958, 272	5. 22	21, 378	81, 766	3. 82	396, 638	2, 040, 038	5. 14

[a] Small quantity of brown rock from Kentucky included with Tennessee.
[b] Blue rock is included with brown rock.

WESTERN STATES

The quantity and value of the phosphate rock sold in the Western States in 1924 were greater than in any previous year except 1920. Although there were no such phenomenal increases as those recorded in 1923, the quantity increased 27 per cent and the value 11 per cent. The average value decreased 75 cents, or 13 per cent. There were three producers in Idaho, one in Montana, and one in Wyoming.

Western States phosphate rock sold in 1916–1924

Year	Long tons	Value at mines		Year	Long tons	Value at mines	
		Total	Average			Total	Average
1916	1, 703	$5, 350	$3. 14	1921	6, 291	$25, 872	$4. 11
1917	15, 096	41, 756	2. 77	1922	4, 481	19, 692	4. 39
1918	11, 955	42, 161	3. 53	1923	30, 335	175, 713	5. 79
1919	16, 935	69, 855	4. 12	1924	38, 570	194, 569	5. 04
1920	55, 609	304, 006	5. 47				

ACID PHOSPHATE PRODUCED IN THE UNITED STATES

According to information from the Bureau of the Census 1,666,303 short tons of acid phosphate, containing 28,027,002 units (20 pounds) of available phosphoric acid, was produced during the second half of 1924, as compared with 1,584,195 short tons, containing 26,547,810 units, during the first half of the year, totaling 3,250,498 tons and 54,574,812 units for the year, as compared with 3,367,220 tons and 55,895,856 units in 1923, a decrease of 3 per cent in tonnage and of 2 per cent in content.

The data for the first half of 1924 are based on the reports of 171 establishments, of which 111 are located in the southern district, distributed by States as follows: Alabama, 15; Arkansas, 1; Florida, 6; Georgia, 37; Louisiana, 4; Mississippi, 6; North Carolina, 16; South Carolina, 17; Tennessee, 8; Texas, 1. The remaining 60 establishments are located in the northern and western districts, distributed by States as follows: California, 2; Illinois, 5; Indiana, 5; Maryland, 10; Massachusetts, 3; Michigan, 1; New Jersey, 4; New York, 1; Ohio, 15; Pennsylvania, 3; Virginia, 11. The manufacture of sulphuric acid was reported to the Bureau of the Census by 60 establishments in the southern district and 28 in the northern and and western districts.

The statistics for the last half of 1924 are based upon the reports of 169 establishments, of which 112 are located in the southern district and 57 in the northern and western districts. For this period the number of establishments reporting in Georgia was 40; Tennessee, 6; Maryland, 9; Massachusetts, 2; and Virginia, 10. For the other States the number reporting for the second half was the same as that reporting for the first half. The manufacture of sulphuric acid was reported by 43 establishments in the southern district and by 23 in the northern and western districts.

IMPORTS OF PHOSPHATIC FERTILIZERS

The phosphatic fertilizers imported in 1924 included bone dust or animal carbon, bone ash, guano, crude phosphates, and basic slag. Imports of the bone-dust group, however, were less than half those of the preceding year both in tonnage and value. Imports of guano were reduced 12 per cent in quantity and 32 per cent in value. The quantity of crude phosphates imported in 1924 was more than double that of 1923, and its value was nearly twice as great. Imports of slag also increased greatly, being nearly double in quantity and 40 per cent greater in value, as compared with 1923. Importations of phosphatic materials for the last five years are shown in the following table:

Phosphatic fertilizers imported for consumption in the United States, 1920–1924

Fertilizer	1920		1921		1922		1923		1924	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Apatite	142	$4,904								
Bone dust or animal carbon, and bone ash, fit only for fertilizing	17,793	908,130	21,516	$799,591	32,274	$860,683	54,143	$1,691,330	22,242	$706,727
Guano	53,790	4,583,313	1,751	89,527	13,007	514,325	28,599	1,104,003	25,241	754,234
Phosphates, crude	63	2,090	3,535	43,960	5,890	95,846	6,725	92,263	16,098	181,515
Slag, basic, ground or unground					324	9,762	361	6,843	703	9,598

EXPORTS OF PHOSPHATE ROCK

The phosphate rock exported from the United States in 1924 decreased 1 per cent in quantity and 11 per cent in value, as compared with corresponding figures for 1923. The quantity was 23 per cent less than that for 1920 and 40 per cent less than the pre-war level (1,366,508 tons in 1913). The following table shows exports of phosphate rock in the last five years:

Phosphate rock exported from the United States, 1920–1924

Year	Ground or unground, not acidulated				Other		Total	
	High-grade rock		Land pebble		Long tons	Value	Long tons	Value
	Long tons	Value	Long tons	Value				
1920	344, 896	$4, 496, 457	693, 355	$5, 593, 814	31, 461	$479, 904	1, 069, 712	$10, 570, 175
1921	182, 594	2, 592, 541	544, 425	4, 627, 875	6, 293	99, 721	733, 312	7, 320, 137
1922	202, 300	2, 548, 587	512, 777	3, 269, 179	4, 217	40, 401	719, 294	5, 858, 167
1923	194, 339	2, 477, 501	630, 565	3, 273, 006	2, 647	21, 664	827, 551	5, 772, 171
1924	150, 746	1, 814, 194	656, 005	3, 209, 965	12, 022	96, 673	818, 773	5,120,832

The destination of these exports is given in the following table, which shows that in 1924 Germany was the principal importer of high-grade rock and the Netherlands second. Germany's imports, however, were 32 per cent less than in 1923 and only 0.15 per cent greater than in 1921, the year of smallest importations in the last 5-year period. Belgium, which held second place in 1923, decreased 42 per cent, whereas the Netherlands increased more than 200 per cent. Poland and Danzig reduced their importations of high-grade rock nearly half, but Sweden, which was not an importer in 1923, took 6,731 tons.

Germany was also the principal importer of land pebble rock in 1924, followed by Spain, the Netherlands, and Italy in the order named. British South Africa and Norway joined the list of countries importing pebble rock, and Argentina, Finland, Greenland, and Nicaragua dropped out. Cuba, Italy, Japan, the Netherlands, Poland and Danzig, Spain, and Sweden all made considerable increases in their importations. The most noteworthy were Italy and Japan, with 179 and 221 per cent, respectively, but the largest proportionate increase was in Poland and Danzig—341 per cent. On the other hand, Belgium, Canada, Denmark, England, France, Germany, and Ireland all decreased their importations; England and France, with 39 and 72 per cent, respectively, being particularly noteworthy, but Ireland had the greatest proportionate decrease—85 per cent.

Small amounts of phosphate rock of other types were exported to several countries, Canada taking the largest quantity.

Phosphate rock, ground or unground, not acidulated, exported from the United States, 1920–1924

High-grade rock

Country	1920		1921		1922		1923		1924	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Belgium	55, 645	$690, 705	41, 513	$622, 695	32, 200	$483, 000	33, 650	$484, 950	19, 500	$292, 500
Canada	2, 226	39, 442	6, 559	89, 262	3, 892	47, 045	------	--------	------	--------
Denmark	58, 211	755, 655	------	--------	4, 400	66, 000	------	--------	------	--------
England	8, 306	124, 587	5, 042	78, 166	------	--------	3, 543	28, 344	------	--------
Finland	------	--------	------	--------	5, 650	74, 759	------	--------	------	--------
Germany	104, 433	1, 407, 445	91, 880	1, 293, 893	113, 118	1, 335, 372	134, 586	1, 700, 187	92, 021	1, 031, 819
Ireland	4, 600	69, 000	------	--------	------	--------	------	--------	------	--------
Japan	4, 292	35, 076	------	--------	------	--------	------	--------	------	--------
Netherlands	19, 522	266, 217	25, 100	328, 900	19, 991	258, 021	8, 140	77, 720	26, 494	355, 195
Norway	30, 978	428, 865	2, 500	38, 500	3, 200	48, 000	------	--------	------	--------
Poland and Danzig	------	--------	10, 000	141, 125	16, 349	183, 890	11, 420	171, 300	6, 000	90, 000
Spain	24, 480	312, 845	------	--------	------	--------	3, 000	15, 000	------	--------
Sweden	32, 203	366, 620	------	--------	3, 500	52, 500	------	--------	6, 731	44, 680
	344, 896	4, 496, 457	182, 594	2, 592, 541	202, 300	2, 548, 587	194, 339	2, 477, 501	150, 746	1, 814, 194

Land pebble

Argentina	------	--------	------	--------	------	--------	1, 700	$7, 650	------	--------
Belgium	26, 788	$216, 934	45, 160	$389, 695	53, 793	$309, 183	61, 434	336, 874	38, 469	$196, 636
British South Africa	------	--------	------	--------	3, 000	17, 250	------	--------	6, 620	34, 755
British West Indies	3, 675	25, 100	------	--------	------	--------	------	--------	------	--------
Canada	3, 854	30, 494	146	2, 676	9, 895	75, 028	10, 031	54, 468	7, 019	40, 551
Cuba	34, 208	262, 204	7, 055	43, 101	9, 017	26, 073	23, 433	83, 022	33, 672	156, 455
Denmark	18, 406	192, 648	9, 062	103, 791	54, 605	429, 984	57, 425	330, 323	38, 072	171, 176
England	154, 975	1, 277, 278	52, 924	422, 495	36, 983	270, 300	55, 093	299, 757	33, 805	134, 774
Finland	------	--------	------	--------	------	--------	2, 000	14, 000	------	--------
France	------	--------	20, 380	124, 323	27, 149	185, 121	31, 466	180, 509	8, 798	43, 641
Germany	9, 129	96, 855	79, 004	884, 135	51, 578	283, 918	133, 948	701, 883	129, 213	628, 143
Greenland	------	--------	------	--------	------	--------	3, 685	16, 597	------	--------
Honduras	------	--------	3, 596	16, 182	------	--------	------	--------	------	--------
Ireland	61, 097	395, 797	36, 713	289, 779	18, 716	141, 504	20, 612	94, 303	3, 000	9, 000
Italy	------	--------	7, 352	73, 520	------	--------	20, 915	96, 540	58, 419	290, 391
Japan	42, 516	322, 428	20, 743	113, 799	8, 201	31, 804	14, 225	50, 081	45, 733	161, 423
Netherlands	70, 477	505, 612	69, 416	558, 912	86, 218	498, 516	67, 702	337, 371	97, 368	472, 666
Nicaragua	------	--------	------	--------	------	--------	3, 029	15, 931	------	--------
Norway	2, 500	22, 500	------	--------	------	--------	------	--------	2, 000	9, 000
Poland and Danzig	------	--------	------	--------	------	--------	3, 028	20, 742	13, 366	70, 420
Portugal	8, 305	55, 381	24, 545	260, 315	------	--------	------	--------	------	--------
Scotland	77, 487	574, 305	17, 438	138, 085	13, 715	104, 014	17, 904	77, 468	18, 282	77, 393
Spain	139, 066	1, 226, 670	133, 462	1, 006, 634	122, 443	788, 027	92, 326	492, 936	110, 146	648, 779
Sweden	40, 872	389, 608	17, 429	200, 433	17, 464	108, 457	10, 609	62, 551	12, 023	64, 762
	693, 355	5, 593, 814	544, 425	4, 627, 875	512, 777	3, 269, 179	630, 565	3, 273, 006	656, 005	3, 209, 965

All other phosphate rock

Canada	12, 955	$187, 780	4, 931	$72, 023	4, 196	$38, 281	1, 600	$17, 137	10, 941	$80, 246
Cuba	8, 134	160, 824	1, 197	23, 635	------	--------	------	--------	81	1, 427
Germany	3, 300	51, 150	------	--------	------	--------	------	--------	------	--------
Honduras	------	--------	22	250	------	--------	------	--------	------	--------
Ireland	2, 500	14, 250	------	--------	19	2, 100	------	--------	------	--------
Japan	1, 382	12, 737	------	--------	2	20	------	--------	------	--------
Mexico	------	--------	110	2, 975	------	--------	------	--------	------	--------
Newfoundland and Labrador	37	316	23	463	------	--------	29	228	------	--------
Norway	------	--------	------	--------	------	--------	------	--------	1, 000	15, 000
Oceania:										
Australia	3	30	------	--------	------	--------	------	--------	------	--------
New Zealand	1	10	------	--------	------	--------	------	--------	------	--------
Other British	------	--------	1	17	------	--------	------	--------	------	--------
Other British West Indies	149	3, 307	9	358	------	--------	12	275	------	--------
Spain	3, 000	49, 500	------	--------	------	--------	------	--------	------	--------
Sweden	------	--------	------	--------	------	--------	1, 006	4, 024	------	--------
	31, 461	479, 904	6, 293	99, 721	4, 217	40, 401	2, 647	21, 664	12, 022	96, 673

The following table shows the relation between the total quantity of phosphate rock sold and the quantity exported during the last five years:

Phosphate rock sold in and exported from the United States, 1920–1924

Year	Sold (long tons)	Exported (long tons)	Proportion of exports to domestic sales (per cent)
1920	4, 103, 982	1, 069, 712	26
1921	2, 064, 025	733, 312	36
1922	2, 417, 883	719, 294	30
1923	3, 006, 706	827, 551	28
1924	2, 867, 789	818, 773	29

The following figures show, for a period of 35 years, the growth and decline of Florida's export phosphate trade and the comparative importance of hard rock and land pebble in this trade. It is noteworthy that in 1923 and 1924 exports of land pebble advanced while those of hard rock declined.

Florida phosphate rock exported, 1890–1924, in long tons[a]

Year	Hard rock	Land pebble	Year	Hard rock	Land pebble
1890	11, 206		1908	631, 001	470, 270
1891	71, 682		1909	478, 820	509, 341
1892	180, 013		1910	461, 353	606, 110
1893	220, 216		1911	449, 798	759, 510
1894	304, 079		1912	470, 354	732, 651
1895	306, 046		1913	476, 898	887, 398
1896	322, 871		1914	287, 292	663, 839
1897	350, 277		1915	42, 283	207, 551
1898	360, 505		1916	31, 911	208, 288
1899	444, 675		1917	9, 341	134, 943
1900	345, 577	86, 886	1918	62, 071	64, 732
1901	419, 349	113, 777	1919	241, 151	130, 974
1902	489, 520	144, 597	1920	344, 254	685, 766
1903	462, 903	152, 961	1921	174, 284	568, 415
1904	490, 366	219, 520	1922	198, 375	519, 954
1905	572, 311	238, 668	1923	191, 222	645, 036
1906	561, 040	214, 727	1924	145, 093	660, 714
1907	591, 719	296, 918			

[a] American Fertilizer, vol. 62, No. 3, Feb. 7, 1925, pp. 32–33.

EXPORTS OF SUPERPHOSPHATES AND OTHER FERTILIZER MATERIALS

The export business in superphosphates (acid phosphates) and prepared fertilizer mixtures showed some increase, the figures for the latter being about double those for 1923. Nitrogenous and other fertilizers showed a marked decrease. The following table shows fertilizer exports in 1913 and 1915 to 1924. Separate records for superphosphates have been kept since 1917. Exports of superphosphates were greater in 1924 than in any years but 1919 and 1920.

Fertilizers exported from the United States, 1913 and 1915–1924

	1913		1915		1916		1917		1918		1919	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Superphosphates (acid phosphates) All other fertilizers	72,747	$1,666,755	114,205	$2,785,804	149,286	$5,010,517						
Superphosphates (acid phosphates)							3,844	$106,778	6,991	$257,928	86,790	$2,774,856
All other fertilizers							174,592	5,627,304	74,115	3,359,497	188,586	14,567,032

	1920		1921		1922		1923		1924	
Superphosphates (acid phosphates)	80,993	2,949,629	4,278	96,303	26,781	372,279	42,099	534,446	45,751	588,620
Prepared fertilizer mixtures	(a)	(a)	(a)	(a)	14,416	690,972	17,997	832,948	35,793	1,695,472
Nitrogenous fertilizer materials:										
Sulphate of ammonia					147,331	8,736,611	153,677	11,117,726	118,367	6,918,598
Calcium cyanamid (lime of nitrogen)					2,556	26,112	(a)	(a)	(a)	(a)
Other					1,663	84,274	13,291	614,814	4,699	283,154
All other fertilizers	205,666	15,602,658	55,239	2,602,277	25,462	898,061	45,073	1,921,972	44,942	1,901,722

[a] Not classified separately.

PHOSPHATE RESERVES OF THE UNITED STATES

The Government now has two extensive phosphate reserves, one in Florida and the other in the Western States.

FLORIDA

The first withdrawal of public land in Florida, which included 2,400 acres, was made on July 2, 1910. Further withdrawals, with some subsequent restorations, have since been made, so that the total lands withdrawn as of May 31, 1925, comprise 84,362 acres, in parcels ranging in size from a fractional subdivision of less than 40 acres to as much as 400 acres and distributed in 295 townships in 31 counties, extending from Apalachicola River at the northwest as far south as Fort Myers. The belt of country thus included ranges from 10 to nearly 100 miles in width. Only 120 acres in Florida has thus far been actually classified as phosphate land.

WESTERN STATES

Since December 9, 1908, the Government has maintained a phosphate reserve in the Western States. The great bulk of the phosphate-bearing area in the States named is on public land, though some has passed into private ownership. The acreage of the reserve has changed from time to time in accordance with the results of geological examinations of the withdrawn lands, but the total has remained large.

Outstanding withdrawn phosphate lands, Western States, May 31, 1925

	Acres
Idaho	396, 612
Montana	279, 944
Utah	301, 945
Wyoming	992, 969
	1, 971, 470

Of this land, areas amounting to 160 acres in Utah, 268,299 acres in Idaho, 25,293 acres in Wyoming, and 3,833 acres in Montana, 297,585 acres in all, have been examined in detail and formally classified as phosphate land. The total classified and withdrawn lands thus amount to 2,269,055 acres, of which only about 10 per cent are classified. Not all this territory contains high-grade rock, but the estimates given below, which are conservative and incomplete, show that a vast tonnage of high-grade rock may be expected.

Under the act of July 17, 1914, agricultural entries may be made upon withdrawn phosphate lands, but the mineral rights are reserved to the United States.

REVISED ESTIMATES OF TONNAGE

Figures for reserves of phosphate in the Eastern States at the end of 1915, prepared by Phalen,[2] have been the basis for later estimates made for these States in reports of the United States Geological Survey. In the estimates for Florida, Phalen allowed 10,000,000 tons for hard rock, 190,000,000 for land pebble, and 27,000,000 for low-grade material in the wash heaps, a total of 227,000,000 tons for the entire State. As reduced by the quantity mined since that date, this estimate in round numbers would be 207,000,000 tons. In the Mineral Resources report, "Phosphate in 1923," figures obtained by G. W. Holland of the Survey showed that the pebble field alone contains a minimum of more than 288,000,000 long tons of minable phosphate. These figures were based on more specific data than those available to Mr. Phalen. Unfortunately, no corresponding figures are to be had for the hard-rock field. Assuming, therefore, Mr. Phalen's hard-rock figure and making deductions for the quantity of rock mined in each field at the end of 1924, the revised figure for Florida becomes approximately 294,000,000 tons.

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[2] Phalen, W. C., "The conservation of phosphate rock in the U. S."; Proc. 2d Pan Amer. Sci. Cong. vol. 8, 1917, pp. 772-806.

No figures are available for Arkansas, Kentucky, South Carolina, and Tennessee more recent than those published in the 1922 report, which were based on Mr. Phalen's estimates. Of these only Tennessee and Kentucky need modification to allow for the quantity of rock mined in 1923 and 1924. Mr. Phalen's estimate for Tennessee was 88,000,000 tons, of which 84,000,000 tons was for blue rock. Making the suggested reduction the estimate for the total at the end of 1924 becomes about 84,000,000 tons.

In connection with the revision and extension of phosphate classification in the western field, the tonnage estimates for the four States comprising that field are subject to periodic revision. These estimates relate chiefly to the main bed, and thus exclude some workable high-grade rock and much lower-grade material that may eventually become workable. Numerous areas of considerable size that may contain phosphate deposits at workable depths are also excluded, because the phosphate rock is covered by later deposits that conceal the structure of the underlying beds, so that any estimate of the phosphate content would be unreliable. No estimate is available for the large areas of withdrawn land not yet examined. It is believed, therefore, that the estimates here given for the Western States are low, and that when the withdrawn lands have been fully explored the total may be considerably increased.

Estimate of phosphate rock in the United States available December 31, 1924, in long tons

Field	Estimated quantity available	Field	Estimated quantity available
Eastern field:		Western field:	
Arkansas	20,000,000	Idaho	5,087,851,000
Florida	294,000,000	Montana	391,323,000
Kentucky	878,000	Utah	326,745,000
South Carolina	8,800,000	Wyoming	115,742,000
Tennessee	84,000,000		
	407,678,000		5,921,661,000
		Grand total	6,329,339,000

GOVERNMENT ACTIVITIES IN PHOSPHATE

Investigations relating to phosphate were undertaken in 1924 by three Government bureaus—the Geological Survey, the Bureau of Soils, and the Bureau of Standards.

GEOLOGICAL SURVEY

In 1924 the Geological Survey investigated phosphate deposits in five States—Florida, Idaho, Montana, Utah, and Wyoming.

Florida.—In Mineral Resources for 1923, Part II, page 250, the general status of Government phosphate lands in Florida was described and the necessity for prospecting certain tracts was indicated. In the early months of 1924 the Geological Survey, in cooperation with the General Land Office, undertook the examination and classification of ten 40-acre tracts. The General Land Office, through Keith K. Kimmel, transit man, identified and located the lands, and a prospecting party under the direction of J. T. Pardee, geologist, obtained the necessary classification data. J. H. Wingate, of Plant City, was the contracting prospector. The prospecting methods employed were usually those current in the Florida phosphate fields. The tracts examined were distributed in six townships, as follows: T. 3 N., R. 2 E.; T. 2 N., R. 6 E.; T. 14 S., R. 23 E.; T. 28 S., R. 22 E.; T. 29 S., R. 23 E.; and T. 30 S., R. 24 E.

The NW. ¼ NW. ¼ sec. 28, T. 3 N., R. 2 E., is a swamp-land claim of the State of Florida. Except for a narrow strip along the east, the tract is submerged by Forshala Lake, a shallow body of water with an outlet underground. Three holes were bored, one at the center and one each in the northeast and southeast quarters of the tract. The holes were 41½ to 48½ feet deep. The results were practically negative, and it was concluded from these results and from general information obtainable on the district that it contained no phosphate deposits of any probable present or future value.

Three 40-acre tracts were examined in T. 2 N., R. 6 E., namely, the NE. ¼ NE. ¼ and the S. ½ NE. ¼ sec. 28. With the exception of about an acre, this entire tract was under 2 to 4 feet of water at the time of the examination. It is a part of the Aucilla swamp, in which Aucilla River has its source, and bears a large amount of merchantable timber.

Twelve holes 27½ to 50 feet deep were bored, three each in the northeast and southeast "40s" and six in the southwest "40." In addition all other available evidence from local sources and from the literature was utilized. No phosphatic material was found in the northeast "40" and only a feebly phosphatic layer in the southeast "40" (SE. ¼ NE. ¼). These tracts lie in the deeper part of the basin and may contain some phosphate at depths not reached by boring. The north part of the southwest "40" (SW. ¼ NE. ¼) contains a deposit 4 to 11 feet thick beneath an overburden 24 to 34 feet thick and covering 20 acres or more. Most of it may be classified as low-grade soft phosphate. Its phosphate content ranges from 11 to 56 per cent and averages about 30 per cent "bone phosphate of lime" (tricalcium phosphate). About 20,000 tons of this material is present per acre. The richer portions contain a little pebble phosphate of fairly good grade. The deposit probably extends northwest beyond the limits of the tracts examined and, as indicated by the boring, becomes thicker, richer, and less deeply buried in that direction. The deposit is not workable under present conditions but might have value in future, if soft phosphate should acquire greater commercial importance.

The NE. ¼ SE. ¼ sec. 31, T. 14 S., R. 23 E., comprises a 40-acre tract lying about a mile north of the celebrated Silver Spring and 6 miles east-northeast of Ocala, Marion County. The ground is low and sandy, and water was standing over a small area along the north side at the time of the examination. Five holes 33½ to 50 feet in depth were bored, one at the center of the "40" and one near the center of each of its four quarters. The results of the work were unfavorable. It is realized that in the hard-rock field, of which this area forms a part, a much larger number of holes is usually employed than in a corresponding area where a body of phosphate is to be delimited. Nevertheless, no bodies more than 7 or 8 acres in extent, and at less depth than 40 or 50 feet could have been missed by the boring. Comparison of data available from the borings with existing knowledge of conditions in the neighborhood leads to the conclusion that the presence of any valuable body of phosphate in this tract is improbable.

The SW. ¼ NE. ¼ sec. 3, T. 28 S., R. 22 E., is about 4 miles north of Plant City, Hillsborough County. About one-third of the area is covered with swamps and ponds; the remainder is only a foot or two above the local water surface. The dry areas are partly cleared and cultivated and partly occupied by a rather thick stand of pines utilized for turpentine. Four holes 30 to 61 feet in depth were bored, one in the center of each quarter or 10-acre lot. The results were unfavorable and it was concluded that no valuable phosphate deposit is present.

One 80-acre tract comprising the W. ½ SW. ¼ sec. 11 and one 40-acre tract comprising the NW. ¼ SW. ¼ sec. 21 in T. 29 S., R. 23 E., were prospected.

The 80-acre tract in sec. 11 is 30 miles east of Tampa and 4 miles south of Lakeland, Polk County. An improved road west from Medulla extends along the south side of the tract. The north half and part of the southwest corner is swampy. This tract had been included in areas formerly prospected by the Geological Survey and by private parties, but because of the difficulties of interpretation it was considered best to check the earlier work. Holes were therefore bored in each 40-acre area of the tract, the location of the holes corresponding as closely as possible to the location of a former Survey boring. The results were found to conform reasonably well to the earlier work. It was concluded that in view of the large number (42) of prospect holes bored on this tract and of the general agreement of the records the amounts of pebble phosphate determined—namely, from 1,100 to 1,300 tons per acre, or totals of 65,000 tons for part and 88,000 tons for all of the tract—are safe estimates.

The 40-acre tract in section 21 is about 30 miles east of Tampa and 3 miles northwest of Mulberry, Polk County, and is less accessible. This tract had also been included in areas formerly prospected by both the Survey and private parties, and for similar reasons a check was desired. Four holes 11 to 25 feet in depth were bored, each at or near the center of one of the four 10-acre plots that comprise the tract. From the results obtained from these borings in comparison with earlier results it was concluded that the lowland, comprising somewhat more than half of the tract, or about 25 acres, contains between 500 and 900 tons of phosphate pebbles per acre, or a total of 12,500 to

22,500 tons. The upland, which includes the remaining 15 acres, contains between 200 and 300 tons per acre, or a total of 3,000 to 4,000 tons.

The NE. ¼ SE. ¼ sec. 4, T. 30 S., R. 24 E., includes 40 acres conveniently located 4 miles west of Bartow, Polk County, on the road from Bartow to Plant City. The soil is sandy and the surface is practically free from standing water. Four holes 51 to 57 feet in depth were bored, one in the center of each of the 10-acre lots that together comprise the tract. The overburden proved to be about 35 feet thick, and a phosphatic matrix in two layers aggregating 18 feet or more was found in each of the holes. The results of the analyses and calculations showed that the tract contains 400,000 tons of pebble phosphate having a phosphate content of 61.88 to 69.65 per cent "bone phosphate of lime" (tricalcium phosphate), similar in grade to the general run of the phosphate deposits in the pebble field. This body is apparently part of a larger body that is now being mined in adjoining areas. Its overburden is somewhat thicker than that in most of the areas hitherto worked, but does not preclude successful mining. In addition to the pebbles the deposit contains an equally large amount of phosphatic clay and sand, which would be wasted under present methods but might ultimately be utilized.

Idaho.—The phosphate beds in Idaho have been studied intermittently by members of the Survey since about 1906, before the reserve was established, and a number of papers relating to them have been published. These were listed in the bibliography given in Mineral Resources for 1922. A considerable area of the reserve still remains unexamined, and as these withdrawn lands can not be disposed of before they are examined and classified, work of this sort is carried on as steadily as the resources and other obligations of the Survey will permit.

No field work was done in Idaho in 1924, but the results of the explorations of the previous year were worked up and lands in 11 townships were classified.

Montana.—In July and August, 1924, J. T. Pardee examined for classification purposes parts of four townships in Montana—T. 7 N., R. 13 W., Tps. 8 and 9 S., R. 2 E.; and T. 9 S., R. 3 E., Montana principal meridian.

The part of T. 7 N., R. 13 W., examined is on the west slope of the Flint Creek Range, Granite County, near Philipsburg, and embraces about 2,080 acres. The examination showed that a minimum of 3 feet of phosphate rock, containing 60 to 70 per cent of tricalcium phosphate, could be safely assumed for purposes of calculating tonnage, and that an estimated total of 34,038,000 long tons of phosphate rock is available for mining above the depth limit of 2,000 feet.

The lands examined in T. 8 S., R. 2 E., comprise 3,760 acres in phosphate reserve No. 30, Montana No. 7, in the Madison Range, about 25 miles southeast of Ennis, in Madison County. The tract is about 1 mile wide and 5 miles long, extending southeast from section 8. The chief phosphate bed is 30 inches thick and averages 56 per cent of tricalcium phosphate. The other phosphate beds are either too thin or too low grade to be considered workable. The depth limit assigned under regulations of the Geological Survey [3] is 1,050 feet. Within this limit the deposit is estimated to contain 6,500,000 tons. Compared with many other phosphate deposits in the western field the bed described is rather thin, poor, isolated, and difficult of access. A long time will doubtless elapse before it is mined.

The area examined in T. 9 S., R. 2 E., which adjoins that of T. 8 S., R. 2 E., on the south, contains about 2,718 acres and forms a strip about 1 mile wide and 4 miles long, extending from section 3 to section 24. The workable phosphate bed ranges in thickness from 1 foot 8 inches, with 65 per cent tricalcium phosphate in section 24, to 2 feet 6 inches, with 56 per cent tricalcium phosphate in section 3. With a depth limit ranging from 600 feet where the bed is thinnest to 1,050 feet where it is thickest, the deposit is estimated to contain in round numbers about 4,000,000 tons.

The lands examined in T. 9 S., R. 3 E., form the continuation of those examined in the adjoining township on the west and include about 1,301 acres in a strip three-quarters of a mile wide and 3½ miles long, extending from section 18 through section 31. The workable bed is 1 foot 7½ inches thick and contains 65.3 per cent of tricalcium phosphate. The depth limit for such a bed is 600 feet, and the quantity of phosphate rock available is estimated at 2,000,000 tons.

Utah.—In September, 1924, J. T. Pardee examined sec. 12, T. 5 N., R. 2 E., Salt Lake meridian, Utah, with a view to classification. The land is 7 miles southeast of Huntsville, Weber County. Exposures are poor, but an outcrop of phosphate, representing a bed of phosphate rock at least 8½ feet thick, averaging 13 feet and containing 60 per cent of tricalcium phosphate, extends northwest across the section. The depth limit for classification purposes is 4,000 feet and the estimated phosphate content not less than 3,600,000 tons.

In August, 1924, E. M. Spieker and J. B. Reeside, jr., examined sections 20, 21, 28, and 29 (unsurveyed), T. 7 S., R. 5 E., Salt Lake meridian, near the west end of the Uinta Mountains. The rocks exposed are much younger than the phosphate-bearing formation, and no evidence was found that phosphate occurs beneath these younger formations at minable depth.

Wyoming.—In September, 1924, J. T. Pardee examined the NE. ¼ of NW. ¼ sec. 5, T. 43 N., R. 118 W., sixth principal meridian, Wyo., for classification purposes. This land is on the east side of Teton Valley, about 4 miles east of Driggs, Idaho. No exposures of older rock appear on the land itself, but a review of the geology of the region, of which it forms a part, leads to the conclusion that it is underlain at a depth of 2,000 feet or more by phosphate of commercial grade. This depth, however, is considered too great to permit the classification of the tract as phosphate land under current regulations of the Geological Survey.

In addition to the activities cited the Geological Survey has received and tested many samples of rock, believed to contain phosphate or to be otherwise valuable for fertilizer, from different parts of the country. Little information of public interest resulted from these tests, since most of the samples tested were deficient in phosphate or too low grade to have commercial importance.

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[3] Smith, G. O., and others, "The classification of the public lands"; U. S. Geol. Survey Bull. 537, 1913, pp. 129–132.

BUREAU OF SOILS

For a number of years scientists of the Bureau of Soils have been experimenting on the volatilization of phosphoric acid in phosphate rock with a view to reducing the cost of treatment under current methods. W. H. Ross, A. L. Mehring, and R. M. Jones,[4] of that bureau, have recently published a brief account of some of their experiments.

The raw materials used in the volatization process of preparing phosphoric acid are phosphate rock, sand, and coke. When these are ignited at the proper temperature under reducing conditions, phosphorus is evolved in the elemental state, and it is this process that is now in use for the commercial preparation of this material. If the ignition is made in a type of furnace from which the air is not excluded, the evolved phosphorus is at once oxidized to phosphorus pentoxide and escapes from the furnace as dense white fumes. Owing to the hygroscopic nature of this fume it readily reacts with the moisture of the air or with moisture driven off from the charge and may be readily recovered as a solution of phosphoric acid by passing through a Cottrell precipitator.

The paper discusses the reactions that may occur when calcium phosphate is ignited with silica and carbon either singly or in combination under different temperatures or other conditions.

BUREAU OF STANDARDS

With the cooperation of a number of fertilizer companies the Bureau of Standards analyzed its standard phosphate rock sample No. 56.[5] The work brought out a number of interesting facts concerning the procedure for the determination of moisture, phosphoric acid, and "soluble iron and alumina" by the old methods and resulted in the discovery of desirable changes in these methods as well as the development of certain new methods. Although special attention was paid to the usual determinations just mentioned, methods for the less commonly determined ferric oxide, alumina, and lime were also included.

The recommendations of the authors are summarized as follows:

The use of boric acid is desirable in preparing solutions for the analysis of phosphate rock, for this lessens the hydrofluoric acid attack on glassware and prevents the interference of this acid in determinations of phosphorus.

Results obtained by solution of the ammonium-phosphomolybdate precipitate and a single precipitation with magnesia mixture can not be correct except through compensating errors, for the precipitate always contains molybdenum and is rarely of ideal composition. If magnesia mixture is added too slowly to neutral or ammoniacal solutions of phosphate the results are usually low. For accurate analyses solution of the magnesium ammonium phosphate precipitate is recommended, followed by the addition of 2 to 3 c. c. of magnesia mixture and reprecipitation by ammonia.

In the alkalimetric method for phosphorus the solution should not be heated after the addition of the molybdate reagent. The 23:1 ratio can not be used in calculating the phosphorus titre of the sodium hydroxide solution unless the method is carefully worked out and followed to the letter.

It is not difficult to get concordant results for "soluble iron." The determination of "soluble alumina," on the other hand, requires rigid attention to a definitely defined method of solution and careful analysis if comparable results are to be obtained.

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[4] Ross, W. H., Mehring, A. L., and Jones, R. M., "Preparation of phosphoric acid"; Jour. Ind. and Eng. Chem., vol. 16, No. 6, June, 1924, pp. 563-566.

[5] Lundell, G. E. F., and Hoffman, J. I., "The analysis of phosphate rock;" Jour., Assoc. Off. Agr. Chem. vol. 8, No. 2, 1924, pp. 184-206.

AMERICAN PHOSPHATE INDUSTRY

According to Ruhm[6] the phosphate-mining plants have about 50 per cent greater producing capacity than the present demand for phosphate rock would appear to warrant, so that the domestic industry is correspondingly depressed. Part of this expansion of capacity came as a result of the revival of European demand after the close of the war. The European market, however, has been greatly altered by the French development in Morocco and the English operations on Ocean, Christmas, and other Pacific islands. As a result of foreign developments Ruhm believes there is little or no hope of any profitable export business in future.

Most of the domestic and all of the foreign demand for phosphate is for fertilizer manufacture; and as the greater part of the fertilizer industry of this country is in the Southeastern States, the greatest development has been in Florida. Tennessee has been left only the market for fertilizer manufactures in the interior States, the furnace trade, and the few consumers of raw ground rock for direct use on the soil. In their present anxiety for business Florida producers have reached out as far as Chicago and St. Louis, although the freight excess to this territory is $4 per ton. In spite of this handicap Tennessee and Kentucky in 1924 produced 431,038 tons, or 15 per cent of the total production for the country. (See p. 78.) Florida may be expected to continue as the largest producer. Most of the prospective developments in producing acid phosphate, phosphoric acid, and phosphorus compounds, however, are being worked out with Tennessee rock, as it seems chemically constituted to yield best to heat treatment, and cheaper power along the Tennessee River is an important possibility.

RUMORED FRANCO-GERMAN AGREEMENT[7]

Since the signing of the Franco-German potash agreement rumors have been current of Franco-German negotiations concerning the supplying of Germany with phosphates from North Africa to the exclusion of American phosphates. It is believed, however, that the potash agreement has no bearing on the phosphate situation, but was merely a trade agreement between two private groups of potash exporters.

Unless some unforseen condition or compensation should arise, the future source of supply for German phosphate requirements is wholly a matter of price, quality, and service.

PROCESSES OF TREATING PHOSPHATE ROCK

Biological process.[8]—Dr. J. G. Lipman and his staff at the New Jersey Agricultural Experiment Station have developed a process for the production of soluble phosphates by biological means. Four parts of ground phosphate rock are mixed with one part of commercial flour sulphur. Cultures of sulphur-oxidizing bacteria are then added, and the mixture is kept at a suitable degree of moisture and temperature. The sulphur is gradually oxidized to sulphuric acid, and this acts on the phosphate rock, producing water-soluble or citrate-soluble phosphate. The practicability of the process is evidenced by the fact that superphosphate has been made by this method, giving results that equal those obtainable by the use of the commercial product.

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[6] Ruhm, H. D., "Phosphate rock"; Eng. and Min. Jour.-Press, vol. 119, Jan. 17, 1925, pp. 99-100.

[7] Daugherty, W. T., "German consumption of fertilizers"; Bureau of Foreign and Domestic Commerce, Chem. Trade Bull. 49-E.

[8] Eng. and Min Jour.-Press, "Biological manufacture of soluble phosphate"; vol. 118, No. 5, Aug. 2, 1924, p. 184.

Enriched superphosphate.—S. I. Volfkovich [9] has described a process for the production of enriched superphosphate whereby low-grade phosphorite is treated with a mixture of sulphuric and phosphoric acids. It is stated that 99 per cent of the phosphorus of the phosphate rock is thus rendered available. Details of the process are not available to the writer.

Phosphor-manganese as a fertilizer.[10]—An artificial fertilizer like a basic slag (Thomas slag) in type but more efficient in action can be produced thermoelectrically from a natural phosphate, manganiferous slag from the spiegeleisen process, lime (CaO), and a basic oxidizing agent such as pyrolusite. The latter is necessary to perfect reduction of the phosphorus at the electrodes and because of the organic substances. The proportions are so regulated that enough base is present to form salts with the silicon, manganese, iron, and aluminum, and enough silicon to dissolve the calcium phosphate.

Electric furnace process.—A brief review of the electric-furnace method of treating phosphate rock, as practiced by the Federal Phosphorus Co., Anniston, Ala., was given in the phosphate chapter of Mineral Resources, 1922. A recent article by Swann [11] describes the process briefly and gives analyses of two grades of ferrophosphorus.

Furnace method.—A recent article by Barr [12] gives a brief interesting account of the blast-furnace method of producing ferrophosphorus used by J. J. Gray, jr., at Rockdale, Tenn. A diagram showing chemical reactions within the furnace at different temperatures is presented, with an analysis of the product.

PHOSPHATE ROCK AS AN INGREDIENT OF STOCK FOOD

Sales of phosphate rock for use as an ingredient of stock food were noted on page 78. According to a letter received from J. R. Dawson, associate in dairy introduction, Bureau of Dairying, United States Department of Agriculture—

> The feeding of minerals to dairy cattle has been receiving considerable attention in the last few years because several important discoveries have been made in investigational work along this line. The best practice probably is for the farmer to grow and feed clover, alfalfa, soy beans, or other legume hays whenever it is at all possible because the legumes are high in mineral content, especially lime. If nonleguminous hays and corn stover are used, or if losses occur from premature birth of calves, it is probably advisable to add from 2 to 4 pounds of ground limestone, steamed bone meal, wood ashes, or floats (ground rock phosphate) to each 100 pounds of grain for the cattle. This can not do any harm and it may do a great deal of good. If the minerals are not completely absorbed by the animals, they enrich the manure, especially when bone meal or rock phosphate is used.
>
> Lime and phosphorus are largely used by dairy cattle in building bone and producing milk. Rations made up of seeds or seed by-products will usually have a low mineral content.

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[9] Volfkovich, S. I., "Production of enriched superphosphate"; Arb. Wiss. Inst. Düngem, vol. 16, 1923, pp. 1–32.

[10] Ongaro, G., ————; Atti cong. naz. chim. pura appl., 1923, pp. 357–369.

[11] Swann, Theodore, "Production of ferrophosphorus in the electric furnace"; Trans. Am. Inst. Min. and Met. Eng., advance leaflet No. 1383–S, issued with Min. and Met., October, 1924.

[12] Barr, J. A., "Manufacture of ferrophosphorus at Rockdale, Tenn."; Trans. Am. Inst. Min. and Met. Eng., advance leaflet No. 1380–M, issued with Min. and Met., October, 1924.

W. H. Black, associate animal husbandman, Bureau of Animal Industry, states in a letter to the writer that:

> For beef cattle it is seldom necessary to supply a mineral other than salt if a liberal amount of legume hay is fed in the ration. Where there is a deficiency of legumes, it is recommended that one part of rock phosphates may be fed to two or three parts of salt. We have no data showing how extensively rock phosphate is used by beef cattle.

The subject is still in the experimental stage, but work already done[13] suggests that a moderate but steady demand for phosphate rock for this purpose may be developed.

PROPOSED TAX ON FLORIDA PHOSPHATE

It has been proposed[14] that a tax be levied in Florida on phosphate rock produced in that State for the combined purpose of raising revenue and conserving the phosphate rock. Proponents of such a measure would do well to study the effects of similar legislation in force in other States before embarking on such a procedure.

MISCELLANEOUS PHOSPHATE ACTIVITIES BY STATES

Florida.—Extensive phosphate-mining operations are to be undertaken near what is known as Banana Lake, Fla., by the Southern Phosphate Corporation. The company controls an extensive property in that district, reported to contain some excellent deposits of phosphate, enough to supply raw material for its uses for a number of years. Operations are under way and machinery is being installed.[15]

A new plant is being erected at Tampa, Fla., by the Kreiss Potassium Phosphate Co., incorporated for the manufacture of potassium phosphate under the Kreiss patents with a capital of $200,000. The company will import fertilizer materials and supply potassium phosphate for domestic and export trade. The process is the same as that in operation at Lakeland, Fla., by the Non Acid Fertilizer Co. The new plant is necessary for the increased demand, which could not be satisfied at the Lakeland plant because of its limited capacity.[16]

The United States Supreme Court on May 4 denied a writ of certiorari by which the Charleston (S. C.) Mining & Manufacturing Co. sought to have it review a decision of the lower Federal courts in a suit by the United States involving title to phosphate lands in Florida. The State of Florida in 1906 filed on public lands under the indemnity school selection act of 1845. Its selection was approved by the Secretary of the Interior. The State then sold part of the lands to the Charleston (S. C.) Mining & Manufacturing Co. Subsequently the Government filed suit to have the sale set aside on the ground the lands had been selected as agricultural land, whereas they contained valuable phosphate deposits and hence were not subject to such selection. The company resisted the suit, declaring the transfer to Florida was regular and that its purchase from the State had been in good faith and could not be revoked. It also contended that the statute of 1845 was enacted long before phosphate deposits were recognized as mineral deposits. The lower courts held for the Government in the suit. By the refusal of the Supreme Court to review the case this decision will stand, and these lands will again come under Government control.[17]

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[13] See, for example, Sheets, E. W., and Jackson, William, A Handbook for Better Feeding of Livestock, U. S. Dept. of Agr. Misc. Cir. 12, 1924; Meigs, E. B., and Woodward, T. E., The Influence of Calcium and Phosphorus in the Feed on the Milk Yield of Dairy Cows; U. S. Dept. of Agr. Bull. 945, 1922, 28 pp. Hart, E. B., Steenbock, H., and Morrison, F. B., Minerals for Livestock; University of Wisconsin Agr. Exp. Sta. Bull. 350, 1923.

[14] Bartlett, C. O., suggests a tax on Florida's phosphate rock; Manufacturers Record, vol. 86, No. 25, Dec. 18, 1924, p. 81.

[15] Commercial Fertilizer, vol. 29, No. 3, October, 1924, p. 50.

[16] Manufacturer's Record, "Erecting phosphate plant at Tampa," vol. 87, No. 19, May 7, 1925, p. 112; No. 22, May 28, 1925, p. 95.

Missouri.—The Lime Phosphate Corporation has been formed at Monett, Mo., for the exploitation of a 1,200-acre deposit of fertilizer-bearing clay, which is said to be 43 feet in depth and but 20 feet under the surface. About 20 acres of the area is said to be known and tested, showing an assay value of $14.25 to $28 per ton.[18]

Montana.—The Darling Phosphate Co., of St. Louis, controlled by Darling Bros., of Chicago, is reported to be opening a phosphate deposit and soon will install a 7-mile aerial tramway to deliver the product to the Northern Pacific Railway near Garrison. The program calls for the ultimate mining of 1,000 tons per day, the product to be shipped to St. Louis. J. T. Wells, of Spokane, is superintendent.[19]

Tennessee.—The Ruhm Phosphate Co.[20] has been erecting a modern plant on the Ridley farm at Ashwood, Maury County, where it has several hundred acres of high-grade rock. The town, the present terminal of the Middle Tennessee Railroad, is 54 miles south of Nashville and 62 miles north of the Muscle Shoals section.

The Interstate Commerce Commission has decided that rates on 320 shipments of phosphate rock from Mount Pleasant, Columbia, and Siglo, Tenn., to New Albany, Ind., over the Louisville & Nashville Railroad since March 1, 1920, were unreasonable and unduly prejudicial.[21]

Phosphate rock when taken from quarries or open pits is not mined within the meaning of the Tennessee mine inspection law, and the fertilizer companies are not subject to payment of mine-inspection fees. A judicial decision to this effect has been rendered in litigation in which all the principal mining companies joined.[22]

RECENT PATENTS

The following patents covering processes for making phosphate rock available in fertilizers have recently been issued. Copies of United States patents may be purchased for 10 cents each from the Commissioner of Patents, Washington, D. C., who will also supply information regarding foreign patents.

UNITED STATES

1497173, June 10, 1924, I. Hechenbleikner. In the production of P_2O_5 and H_3PO_4 from the smelting of a charge containing phosphate rock, coke, and sand in an electric arc furnace a jet or current of air is introduced substantially at the slag level in the furnace to oxidize the phosphorus and produce P_2O_5.

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[17] Chemical and Metallurgical Engineering, "Government wins suit to hold phosphate lands" (Supreme Court of the United States, Order No. 1074, May 4, 1925); vol. 32, No. 11, May, 1925, p. 526.

[18] Commercial Fertilizer, vol. 29, No. 4, November, 1924, p. 50.

[19] Salt Lake Mining Review, vol. 26, No. 22, Feb. 28, 1925, p. 22. Also in the Mining Jour. (London), Mar. 14, 1925, p. 213.

[20] Commercial Fertilizer, "Tennessee phosphate notes," vol. 29, No. 4, November, 1924, p. 53.

[21] Docket No. 13525, reported 91 Interstate Commerce Commission 31; Chem. and Met. Eng., vol. 31, No. 1, July 7, 1924, p. 28.

[22] American Fertilizer, vol. 61, No. 1, July 12, 1924, p. 30.

1497727, June 17, 1924, Federal Phosphorus Co. This patent for an electric method in the production of phosphoric acid has been assigned to the Federal Phosphorus Co. by Bethume G. Klugh. Tricalcium phosphate is reduced by silica and carbon in an electric furnace. The charge is introduced around the electrodes and the vapors are burned while in contact with the entering charge, so as to transfer directly as much of the heat of combustion as possible. The oxidized products then pass through checkerwork regenerators to coolers and electric precipitators. These are in duplicate, and on reversal the air for combustion is preheated in the first regenerator while the hot gases reheat the second regenerator.

1504339, August 12, 1924, W. Glaeser. Dicalcium phosphate is reacted upon with sodium binoxalate in the presence of H_2O while the mixture is agitated. The NaH_2PO_4 is separated from the calcium oxalate by filtration and is then evaporated to recover it in solid form.

1504340, August 12, 1924, W. Glaeser. This patent specifies the treatment of phosphate rock or similar phosphatic material with H_2SO_4 and H_2O to produce monocalcium phosphate, followed by treatment of the latter with sodium oxalate to produce NaH_2PO_4.

1511929, October 14, 1924, H. E. Alcock. A solution of H_3PO_4 to be purified is caused to react with NaOH and Na_2CO_3. The solution of sodium phosphate thus obtained is reacted on with barium sulphide and the barium phosphate formed by this reaction is then decomposed by somewhat less than a chemically equivalent proportion of H_2SO_4.

1513088, October 28, 1924, H. W. Charlton. A fluid mass of phosphate rock and sand is disintegrated and the slag is caused to form matted threads adapted for use as slag wool. P_2O_5 is carried off by air currents and is recovered.

1517687, December 2, 1924, A. Voerkelius. Phosphate-bearing materials, such as Algiers phosphate, are treated with HNO_3 to form $Ca(NO_3)_2$ in the presence of K_2SO_4 or other soluble sulphate, thus producing $CaSO_4$ and nitrate of potassium by reaction with the soluble sulphate.

1518019, December 2, 1924, R. C. Tolman. A charge of sand, phosphate rock, or similar nonmetallic phosphatic material, and carbonaceous reducing material, such as coke, is incorporated with a relatively small proportion of ferrophosphorus or a similar catalytic metal-phosphorus compound, and the charge is furnaced at a temperature high enough to volatilize a quantity of phosphorus approximately equal to that of the chief phosphatic material under treatment. The metal-phosphorus compound is recovered from the charge and used for continuing the process with further charges.

1535120, April 28, 1925, S. B. Kanowitz, Greensburg, Pa., and H. A. Webster, Columbia, Tenn. Kanowitz, assignor to Raymond Bros. Impact Pulverizer Co., Chicago. A method of air separation of high-content phosphate from low-grade phosphate and clay.

GREAT BRITAIN

215813, January 18, 1923, B. Laporte (Ltd.) and H. E. Alcock. In the production of pure H_3PO_4, acid barium phosphate is prepared from di or tri sodium phosphate (or potassium or ammonium phosphates) and barium sulphide and then decomposed with H_2SO_4.

NORWAY

39076, June 16, 1924, Erling Johnson. The dust or vapor from a thermic or electrothermic process for the production of phosphoric acid is precipitated with other waste gases containing basic compounds, such as cement-kiln gases or ammoniacal gases.

SWEDEN

55083, September 12, 1923, Aktiebolaget Før Kem. och Elektrokem. Produktion and E. Lustig. Phosphates are reduced by coal or other reducing material. The phosphorus is oxidized by air drawn into the oxidation chamber, which is placed above the outlet for the combustion gases from the furnace. The heat liberated by the oxidation may be utilized for preheating the charge in the furnace or for other purposes.

WORLD PRODUCTION AND CONDITIONS

The United States, with a total production of 2,913,817 metric tons in 1924, still leads the phosphate-producing countries of the world, but its lead over Tunis, which ranks second, has been reduced to little more than 40,000 tons. The total production of the Mediterranean countries in 1924, however, exceeded that of the United States by more than a million tons.

In 1924 Egypt increased its production over that of 1923 nearly three and one-half times. Exports from Morocco in 1924 were nearly twice the quantity produced in 1923, and production in Algeria and in Tunis in 1924 was 44 and 23 per cent, respectively, greater than in the preceding year. In the United States, on the other hand, production declined 5 per cent as compared with 1923.

The expansion of phosphate production in Mediterranean countries undoubtedly reflects the increasing importance which phosphates from these countries are assuming in European markets. Their relatively high quality and their nearness give them an advantage over material imported from the United States. It is mainly a question of price, however, and American producers have already taken steps to cut the costs of production and transportation and to enable them to compete in European markets. The Riffian revolt is a disturbing factor in the Moroccan phosphate industry which will undoubtedly greatly reduce production in that country in 1925. It may, however, indirectly provide a means for increasing United States exports. Already there are indications of increasing activity in the Florida hard-rock field, which has hitherto been chiefly concerned with export business.

Any relief to American producers afforded by the disturbed conditions in Morocco is likely to be temporary. Producers should adhere to their plans for maintaining a place in the European markets, but they should look more and more to the development of domestic markets through the extension of better farming methods and wider use of fertilizers in this country.

The following table, prepared by Miss L. M. Jones, of the Bureau of Mines, shows the world's production of phosphate rock for the last five years:

World's production of phosphate rock, 1920–1924, in metric tons

Country	1920	1921	1922	1923	1924
Algeria	502,614	398,800	484,304	467,384	671,150
Angaur	[a] 30,500	[a] 30,500	[a] 30,500	[a] 30,500	[a] 30,500
Australia:					
New South Wales	156	203	12	75	109
Queensland		375	66		(b)
South Australia	8,893	5,161	2,759	453	(b)
Victoria	4,290	1,566	1,114	488	541
Belgium	133,040	55,040	56,840	23,270	(b)
Canada [c]		27	172	27	(b)
Chile [c]	1,510	1,200	500	(b)	(b)
Christmas Island (Straits Settlements) [d]	70,692	87,893	100,947	71,563	(b)
Dutch West Indies: Curação [d]	61,440	60,872	50,078	85,855	91,674
Egypt	114,813	122,024	60,220	25,370	87,869
France	124,929	111,984	146,526	(b)	(b)
Germany: [c]					
Bavaria	4,934	7,959	4,412	2,975	(b)
Prussia	1,927	925	657	2,311	(b)
India (British)		[c] 353		[e] 4,838	(b)
Indo-China	13,200	9,900	7,600	9,847	(b)
Japan	97,340	32,001	12,320	33,107	(b)
Taiwan		18	(b)	(b)	(b)
Madagascar [d]			5,210		744
Makatea Island	32,000	60,000	71,350	74,230	(b)
Morocco, French	(b)	33,000	96,397	225,395	[d] 430,340
New Caledonia	11,421	5,000	5,142	12,932	(b)
New Zealand	5,427	6,108	3,178	2,421	(b)
Norway [c]		1,068		222	(b)
Ocean and Nauru islands	[f] 392,000	[g] 370,000	[g] 367,000	[h] 316,652	[h] 459,162
Portugal	1,775	1,054	(b)	(b)	(b)
Russia	(b)	(b)	3,634	(b)	(b)
Spain	42,896	38,064	6,492	5,397	(b)
Tunis	1,075,180	1,800,000	2,117,650	2,338,000	2,872,000
United States	4,169,851	2,097,153	2,456,690	3,054,964	2,913,817

[a] Estimated annual production.
[b] Data not available.
[c] Apatite.
[d] Exports.
[e] Of this quantity 1,099 tons represents apatite.
[f] Eighteen months, July, 1919, to December, 1920.
[g] Production in the fiscal year ended June 30 of year stated.
[h] Exports during the fiscal year ended June 30 of year stated.

An interesting historical, statistical, and economic review of developments in phosphate rock throughout the world has recently been given by A. N. Gray.[23]

NOTES ON FOREIGN PHOSPHATE

ALGERIA

In a report from Algiers,[24] Vice-Consul D. C. Elkington states that all the phosphate deposits in Algeria are being actively worked except those of the Djebel-Onk, 62.1 miles south of Tebessa, which are perhaps the most important. They were discovered over 20 years ago but are still without transportation facilities, owing to the lengthy discussions that have risen over the construction of the necessary railroad. These deposits are conservatively estimated to contain 1,000,000,000 metric tons. The beds are 30 to 60 m. thick, 3 km. wide, and 10 km. long and are free from either silica (quartz) or calcareous clay. Every 300 or 500 meters they are cut by ravines which will permit their exploitation by quarry methods for several centuries.

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[23] Gray, A. N., "The world position as to phosphate rock"; American Fertilizer, vol. 62, No. 6, Mar. 21, 1925, pp. 23–30, and No. 7, Apr. 4, 1925, pp. 21–27.

[24] Elkington, D. C., "Prospective Algerian phosphate developments"; Commerce Repts., Nov. 10, 1924, pp. 349–350

The purity of the product is sometimes above 80 per cent, although it generally varies from 60 to 69 per cent. It is conceded that 500,000,000 metric tons is about 66 per cent pure. Only traces of iron and aluminum have been found. The absence of silica will make crushing easy and the freedom from water will obviate the necessity for drying.

The exploitation of the Djebel-Onk phosphate depends principally on the construction of a railroad. As the matter now stands the successful bidder for a concession will have to finance the building of a railroad from the deposits to Tebessa, whence shipments will be carried to the seaboard at Bone, Philippeville, or some other port. Much doubt has been expressed that the Government will find anybody to make a bid on such terms, so the question may have to be reconsidered in the Algerian financial delegations and superior council, and perhaps also in the French legislative bodies in order to change the present law.

A comprehensive account of the Algerian phosphate beds, including information on their character, distribution, thickness, quality, geological relations and exploitation, with maps and sections, has recently been given by Dussert.[25]

Production in Algeria was greater in 1924 than in any previous year, amounting to 671,150 metric tons, as compared with 502,614 tons in 1920 and 484,304 tons in 1922, the two earlier years of greatest production.

EGYPT

During the last 10 years the importation of fertilizers has more than doubled in Egypt. In 1913 the imports were 71,654 metric tons, valued at $3,254,300, and in 1923, 101,754 metric tons, valued at $5,260,877. Phosphate is mined at Safaga on the Red Sea, and at Sebaria, Upper Egypt, but due to the high cost of manufacturing the raw product into superphosphate practically the total production is exported for manufacture, only a small proportion being ground for local consumption. The exports of phosphate amounted to 70,317 metric tons during the first seven months of this year, which was nearly double the amount during the same period in 1923. The principal purchasers of Egyptian phosphate were Japan, Spain, Ceylon, and Italy. Superphosphate is supplied principally by Holland, Greece, and Belgium and the importations from January 1 to July 31, 1924, were 4,777 metric tons, or about the same as for the corresponding period in the previous year. Imports of the year 1922 were 10,378 metric tons, and in 1923, 22,516 metric tons.[26]

Production of phosphate rock in Egypt in 1924 was 87,869 metric tons, or about three times that of the preceding year. The greatest production in the last five years was 122,024 tons in 1921.

MOROCCO

Steady progress in the sales of Morocco phosphate is indicated in the official figures for 1924, the total being 430,340 tonnes (metric tons), as against 190,000 tonnes in 1923 and 79,000 tonnes in 1922. In an article on the prospects of the industry, reviewed recently in the French technical press, the writer says that the future production is not dependent on the extent of the deposits, which are practically unlimited, but on the demand for consumption and such factors as railway transport and the amount of labor available. As regards transport, the construction of railways and loading quays at Casablanca, Fedhala, Safi, and Mogador presents no particular difficulty. Labor is a more serious problem in view of the relatively low production per man and the cost of raising the phosphate, as shown by an analysis of the report on the Regie for 1923. In that year some 2,000 natives and 396 Europeans were employed in the mines, and in order to raise the production to 1,000,000 tonnes per annum the number would have to be increased to 20,000, which is more than the total population of the region under development. The industry can in future only rely on the normal yearly increase in consumption, and it will be necessary to take into account the diminished purchasing power of many countries. The high quality and richness of Morocco phosphate should, however, enable the industry to maintain and strengthen the position it has secured in the market.[27]

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[25] Dussert, M. D., Les gisements algériens de phosphate de chaux, Ann. des mines, 12th ser., t. 6, 9e liv., September, 1924, pp. 135–221; 10e liv., October, 1924, pp. 229–325; 11e liv., November, 1924, pp. 333–398; 12e liv., December, 1924, pp. 407–451.

[26] Ives, Ernest L., "Fertilizers—Egypt"; Bureau of Foreign and Domestic Commerce, Chem. Trade Bull. 51-E, Dec. 6, 1924.

According to Consul H. Earle Russell, Casablanca, Morocco,[28] the Office Cherifien des Phosphates has not as yet announced figures as to production of phosphates during the first three months of 1925, but between 65 and 70 cargoes have been shipped from Casablanca, which would indicate a tonnage of between 130,000 and 140,000 metric tons.

Exploitation of the deposits of Kourigha, in addition to those at Boujniba, has been recently begun. The former appear to be the richest and most important that have been discovered, and even with most intensive exploitation unlikely to be exhausted for several generations. The character of the deposits is said to often surpass 80 per cent of pure phosphate of lime.

The Office Cherifien has never announced any figures indicating costs of extraction and of laying down each ton in the port of Casablanca. Considering that the mineral must be extracted, culled over, crushed, loaded on cars, carried 90 miles to Casablanca, loaded on a vessel, and transported varying distances by water, and is being sold in French or English ports at less than 100 francs per metric ton (about $5.25 per ton), it is the opinion of some economists that a loss is being incurred.

The Office Cherifien is striving to reduce costs of handling and of transportation. At Boujniba there has been for some time a very up-to-date plant for the crushing and drying of phosphate, and recently an equally modern plant for storing and loading has been installed there. The accumulators are constructed of reinforced concrete, 120 meters long, 60 meters wide, on trusses of 20 meters, and have a capacity of 60,000 metric tons. The phosphate is brought from the crushing and drying section of the plant to the upper part of the storage bins and distributed over the entire surface by a belt. Six series of hoppers allow the loading of the cars in rapid succession, so that a train of 300 tons can be loaded in two minutes by each series. Nearly all of the phosphate is now brought to Casablanca by the normal-gauge railway line, a distance of about 90 miles. From a point near Kourigha to the sea there is a gentle incline, which will permit cheap transportation when the line is electrified. The warehouses at Roches-Noires, a suburb of Casablanca, are no longer being used, and the loaded cars are run directly to the port and unloaded automatically, the contents being carried by belts to the top of the elevator, whence they are discharged into the holds of the vessels lying alongside the quay. The present elevator can load vessels at the rate of 350 metric tons per hour, or more than double the present necessary rate.

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[27] Mining Journal, London, Feb. 28, 1925, p. 191.

[28] Bureau of Foreign and Domestic Commerce, Notes on the Production of Phosphates in Morocco; Spec. Circ. 105, July 13, 1925.

It is reported that the Office Cherifien hopes eventually to be able to export not the crude phosphate, but the superphosphates, electrophosphates, phosphazote, etc., which can support higher freight rates more easily than can the phosphate itself. The preparation of superphosphates has already been started in a small way at Casablanca. Up to the present time the necessary pyrites have come from abroad, as the schists containing them, though found in various localities in Morocco, even near Casablanca, have so far been discovered in exceedingly small quantities, and the desirable blende, with its sulphur and zinc, not at all. Electrophosphates can be manufactured economically, it is claimed, though they are not yet largely used. A small factory is now engaged in this work at Fedalah, 11 miles north of Casablanca. Phosphazote is not yet produced in Morocco.

TUNIS

Trade Commissioner Daniel J. Reagan reports [29] that the production of phosphates by the larger enterprises in Tunis shows increases during 1924 as compared with 1923. The production of the Société des Phosphates et des Chemins de Fer de Gafsa amounted to 1,730,000 tons as compared with 1,610,000 tons in 1923. The production of the Société des Phosphates Tunisiens during 1924 was approximately 525,000 tons, as compared with 424,000 tons in 1923. The production of the Société des Phosphates de Constantine, approximately 600,000 tons, was practically the same in 1924 as in 1923. Deliveries by this company, however, rose from 487,000 tons in 1923 to 720,000 tons in 1924.

Figures for other companies were not complete at the time the above communication was written. The total figure for production for Tunis in 1924 is 2,872,000 metric tons, which is greater than in any previous year and 23 per cent greater than the 1923 figure, 2,338,000 tons.

OTHER COUNTRIES

Australia.—The largest deposits of rock phosphate so far discovered in Australia occur in south Australia. These are distributed intermittently along a belt of country some 200 miles long from Myponge in the south to the district around Carrieton in the north. The phosphate, which is white, yellow, and brown, occurs in gray clay, calcareous marl, and sandy clay in the form of nodules and bed-like segregations. There is no regular stratification. These beds are associated with Cambrian limestones, quartzites, and sandstones. Selected ore of high grade—over 60 per cent tricalcic phosphate—is sent to the superphosphate plants of Wallaroo and Port Adelaide, but there is a larger tonnage of low-grade material which remains unused. From 1913 to 1922, 57,332 long tons was mined, but the quantity appears to be falling off, for 8,753 long tons was mined in 1920, 5,079 long tons in 1921, and only 2,715 long tons in 1922.

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[29] Reagan, D. J., "World trade notes on fertilizers;" Bureau of Foreign and Domestic Commerce Chem. Trade Bull. No. 54-E. Mar. 17, 1925.

The phosphate deposits of New South Wales are all cave deposits and, with the exception of a little bat guano used by local farmers, consist of limestone and bone breccia, as the phosphate does not penetrate far into the solid limestone. Attempts have been made to boom these cave deposits, but they never proved a commercial success. Caves in the neighborhood of Cowra provided 576 long tons of phosphate in 1919. Some phosphate has also been won from the Ashford caves in the Inverell district. In Queensland a limited amount of low-grade guano, 50 per cent, has been mined on small islands off the coast. At Clarendon on the South Island of New Zealand a low-grade phosphate rock is mined.[30]

The Phosphate Cooperative Co. of Australia, which is working deposits in the mandated territory in the South Seas as well as at Mansfield, has partly completed its works of 47 acres at North Shore, Geelong. The company aims at an initial output of 60,000 to 80,000 tons of fertilizer a year.

Shipments of phosphate from Nauru and Ocean Island to Australia during the year ended June 30, 1924, amounted to 320,031 tons. New Zealand received 60,850 tons. The bulk of the rock shipped to Australia went to Port Kembla, 60 miles south of Sidney, where especially large works have been established by Australian Fertilizers (Ltd.).[31]

Nauru and Ocean Island phosphates are also used at the superphosphate plant of the Sulphide Corporation (Ltd.), at Cockle Creek, New South Wales. The plant includes much labor-saving equipment, and the product is marketed mostly as 17 per cent water-soluble P_2O_5, though some 20 to 21 per cent material is sold.[32]

China.—Apatite that gives promise of commercial importance occurs at Tung Hai Hsien on the Chao Ho (river) in Kiangsu Province, eastern China, about 10 miles from a seaport on the China Sea called Hsin Pu Cheng, where steamships of moderate draft may be handled at high tide. The deposits were developed by the Chin Peng Mining Co., approximately 6,000 tons of ore being mined, of which 2,000 tons was exported to Japan. A narrow-gauge railroad connects the east and west mines and the river front. Mining operations are now suspended.

The ore has a specific gravity of 3.130, is friable, and can be ground readily. It contains 41.20 per cent P_2O_5, equivalent to 90.13 per cent $Ca_3(PO_4)_2$, "bone phosphate of lime," 0.67 per cent iron and alumina combined, and 1.80 per cent silica, hence is one of the highest-grade phosphatic ores known. It occurs with manganese ore as a replacement in limestone associated with gneissic rocks of Archaean age.[33]

China has a large trade in bones for manufacture into a variety of articles and for fertilizer.[34]

Esthonia.—A Reval manufacturer experimented in the manufacture of superphosphates several years ago, using phosphates from a territory near Hirro. The experiments proved successful, the quality of the material produced being reported equal to that of foreign products. The factory intends to manufacture large enough quantities for local requirements and for export. Large-scale production, however, depends upon the enlargement of the present sulphuric acid works.[35]

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[30] Power, F. D., "Phosphate deposits of the Pacific"; Econ. Geol., vol. 20, No. 3, 1925, pp. 266–281.

[31] Pauly, E. G., "Phosphates—Australia"; Bureau of Foreign and Domestic Commerce, Chem. Trade Bull. 47–E.

[32] MacGruer, D. C., "The sulphuric acid and superphosphate plants of the Sulphide Corporation (Ltd.), at Cockle Creek, N. S. W."; Chem. Eng. and Min. Rev., vol. 13, No. 191, Aug. 5, 1924, pp. 444, 445.

[33] Memminger, C. G., "Chinese phosphate deposits"; Am. Fertilizer, vol. 61, No. 10, Nov. 15, 1924, p. 27.

[34] Bureau of Foreign and Domestic Commerce, China's Trade in Bones; Chem. Div. Spec. Cir. 99, May 7, 1925.

France.—Statistics of phosphate production in France in 1923 and 1924 are not available.

Four factories of considerable size manufacture sulphuric acid at Bordeaux, chiefly for the production of superphosphates. The phosphates are imported from Algeria, Tunis, and some from the United States. The total quantity of phosphates imported annually for these factories is about 145,000 metric tons. The total annual production of sulphuric acid is about 150,000 tons. Exportation of superphosphates was prohibited during the war and even after the armistice. Statistics covering the exports of superphosphates for recent years are not available.[36] Keen rivalry exists among the producers of superphosphate. A single company, however, the "St. Gobain," dominates the superphosphate business in France. Of 2,200,000 tons of superphosphate produced to-day it provides 1,200,000 tons.[37]

The chamber of commerce, Nancy, announces that the production of basic slag during 1924 will be about 1,200,000 metric tons, of which about 400,000 tons will be consumed in France. Efforts are being made to increase the local consumption through a special organization to spread propaganda among farmers.[38]

Germany.—The agricultural year 1924 will show 65 per cent decrease in the use of phosphoric acid fertilizers in Germany, as compared with the previous year, according to the Deutsche Bergwerkszeitung. It is stated that from May 1 to December 31, 1923, only 82,000 tons was used, as compared with 336,000 tons in the same period of 1913. The amount of phosphoric acid fertilizer used in Germany has never quite reached 50 per cent of pre-war years. Prices are said to be one and one-half times as high as during war times.[39] Germany is producing about 1,000,000 tons of Thomas slag annually with a P_2O_5 content of about 160,000 tons.[40] She is the principal export market for American phosphate rock and has about 80 plants that convert the rock into superphosphates.[41]

Great Britain.—According to a report of the permanent committee on basic slag in Great Britain it is estimated that the annual consumption of slag in agriculture in England and Wales is 300,000 tons.[42] Imports of phosphate of lime and rock phosphate from January to September, 1924, were 243,983 long tons, as compared with 254,455 tons for the corresponding period in 1923,[43] a decrease of 4 per cent. Imports of basic slag likewise decreased from 67,536 long tons during the stated interval in 1923 to 39,171 tons in 1924, or 42 per cent.

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[35] Mayer, C. J., "Production of superphosphate in Esthonia," Bureau of Foreign and Domestic Commerce, Chem. Trade Bull. 44–E, Oct. 13, 1924.

[36] Memminger, Lucien, "Phosphates—France"; Bureau of Foreign and Domestic Commerce, Chem. Trade Bull. 38–E, August, 1924.

[37] American Fertilizer, "Superphosphates in France—keen rivalry"; vol. 62, No. 1, pp. 57, 58, 60, Jan. 10, 1925.

[38] Bureau of Foreign and Domestic Commerce, "French basic slag production increasing"; Chem. Trade Bull. 49–E.

[39] Dumont, F. T. F., "Phosphoric acid used in Germany"; Com. Repts., Aug. 4, 1924, p. 296.

[40] American Fertilizer, "German Thomas slag producers complain of lost markets"; vol. 62, No. 4, p. 33, Feb. 21, 1925.

[41] Daugherty, W. T., "German consumption of fertilizers"; Bureau of Foreign and Domestic Commerce, Chem. Trade Bull. 49–E.

[42] American Fertilizer, "A British report on basic slag"; vol. 62, No. 7, Apr. 4, 1925, p. 42.

[43] Nutting, Alfred, "British fertilizer exports increase"; Bureau of Foreign and Domestic Commerce, Chem. Trade Bull. 50–E, Nov. 22, 1924.

Greece.—The production of superphosphate in Greece in 1921 was 13,300 metric tons. In 1922 it rose to 14,400 tons, but in 1923 it fell sharply to 9,683 tons. The value of the 1923 product was about $405,000.[44]

India.—India possesses deposits of natural rock phosphate, such as those of Trichinopoly and Bihar, and also an unfailing supply of bones, neither of which is being utilized to any considerable extent at present for fertilizer. Experiments in composting indigenous mineral phosphates with sulphur, as has been done by McLean in America, have been satisfactorily performed at Pusa. The solubility of phosphate rock is increased by oxidation of the composted sulphur by soil bacteria. The ratio of 120 parts of sulphur to 400 parts of phosphate and 2,000 parts of soil, as determined by McLean, was employed. As a result 88.9 per cent of the insoluble mineral phosphorus or 95.9 per cent of the pure tricalcium phosphate was rendered available in 10 weeks.[45]

Italy.—Imports of phosphate rock into Venice during the first half of 1924 totaled 75,023 tons, most of which came from Tunisia. It was all destined for use as fertilizer and worked to superphosphate by factories in the region.[46]

The monthly business and financial report of the General Federation of Italian Industries has issued the following statement relative to the production of fertilizers in Italy: [47]

> By far the largest producer of fertilizers is the "Montecatini" Co. Mineral superphosphates are the fertilizer for which demand is heaviest. They are manufactured by the "Montecatini" in no less than 40 factories scattered throughout Italy, with an annual output of over 700,000 metric tons, equivalent to three-quarters of the demand on the home market.

Japan.—Japan is a growing market for American land-pebble phosphates. Exports have increased from 8,201 long tons in 1922 to 14,225 in 1923, and 45,733 during 1924.[48]

New Zealand.—Negotiations are said to be practically complete for the establishment of a fertilizer plant at Wanganui in the Wellington consular district at a cost of £150,000 to £170,000 and with a capacity of 50,000 to 60,000 tons of fertilizer a year. The chief feature of the plant is the conversion into superphosphates of phosphate rock from Nauru.[49]

For the financial year of the Phosphate Commission ended June 30, 1925, it is understood contracts have been made under which all phosphate rock required for New Zealand manufacturers would be derived from Nauru and Ocean Islands. It is estimated that up to 80,000 or 85,000 tons will be imported during that period.

As noted on page 104, low-grade phosphate rock is mined at Clarendon, on the South Island.

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[45] Hutchinson, C. M., "The utilization of indigenous phosphates in India"; Agr. in India, vol. 19, 1924, pp. 4-14.

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[47] American Fertilizer, "Fertilizers in Italy"; vol. 61, No. 3, Aug. 9, 1924, p. 44.

[48] Bureau of Foreign and Domestic Commerce, "World trade notes on fertilizers; phosphates—Japan"; Chem. Trade Bull. 53-E, Feb. 28, 1925.

[49] Gunsaulus, Edwin N., Rept., Oct. 23, 1924.

Norway.—Although Norway has an excess of nitrogenous fertilizers, it lacks necessary amounts of potash and phosphates. In 1923, therefore, 24,325 tons of superphosphates, 18,675 tons of Thomas phosphate, and 16,898 tons of kainite and other potash fertilizers were purchased from foreign countries, chiefly Germany, the Netherlands, and Belgium.[50]

During and immediately after the World War a considerable number of factories were established in and near Frederiksstad, Norway. Practically all of these war plants later went into bankruptcy. One is now to be reconstructed for the manufacture of phosphorus. At present the only factory of this kind in Scandinavia is at Falun, Sweden. The Frederiksstad plant will, it is estimated, be in position to supply all the phosphorus required by the Norwegian match industry.[51]

Pacific Islands.—The chief phosphate-bearing islands are in the Pacific. Angaur Island, of the Pelew group, supplies the Japanese with about 30,000 tons of rock phosphate annually. Raza Island, which belongs to Japan, is also being mined for phosphate. Makatea, in the Paumotu group, produces some 39,000 tons for the French. By far the greatest amount of rock phosphate, however, is mined from the extensive and rich deposits on Ocean and Pleasant (Nauru) Islands, which are under the control of the British.

Exports from Nauru and Ocean Islands during the fiscal year ended June 30, 1924, were 459,162 metric tons, as compared with 316,652 tons in 1923. According to the British Phosphate Commission's report for the fiscal year cited, Australia took 70.67 per cent, New Zealand 13.45 per cent, and other countries except the United Kingdom 15.87 per cent. The United Kingdom did not exercise her right to 42 per cent of the output.[52]

Most of the guano islands of the Pacific are within the Tropics. Among many that have been worked in the past but are now either depleted or too poor to be worked under existing conditions are the Howland and Baker Islands in the central Pacific; islands of the Phoenix group; Laysan and Gardner Islands in the Hawaiian group; Raine, Bunker, and Lady Elliott Islands off the North Queensland coast; and Washington, Fanning, Starbuck, and Jarvis Islands. Guano islands being worked at the present day are Clipperton, belonging to Mexico; Pescadores, Guañape, and Chincha Islands, belonging to Peru; and Malden Island, belonging to Great Britain, which has been worked for over 60 years.

Guano phosphate has been worked on Surprise, Fabre, and Le Leizour Islands of the Huon group, north of New Caledonia, and Walpole Island, south of New Caledonia, both belonging to the French.[53]

Philippine Islands.—The discovery of extensive deposits of guano in the Province of Cebu, Philippine Islands, is reported. A local market for such a fertilizer would be found in the sugar plantations of the islands.[54]

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[50] Swift, A. H., "Norway as a chemical market"; Commerce Repts., Mar. 23, 1925, pp. 690–691.

[51] Sorensen, H., "Norwegian phosphorus factory planned"; Bureau of Foreign and Domestic Commerce, Chem. Trade Bull. 49-A, Nov. 15, 1924.

[52] American Fertilizer, vol. 63, No. 1, July 11, 1925, p. 27.

[53] Power, F. D., "Phosphate deposits of the Pacific"; Econ. Geol., vol. 20, No. 3, 1925, pp. 266–281.

[54] American Fertilizer, vol. 61, No. 8, Oct. 18, 1924, p. 31.

Russia.—The largest phosphorite deposits thus far discovered in the Soviet Union are situated in Vyatka Province, but there are no immediate prospects for large-scale exploitation. The Yegorievsk phosphorite deposit in the central part of European Soviet Russia, near Moscow, does, however, have such possibilities. This deposit is already being worked to some extent by mechanical methods and yields a phosphate mineral well adapted to the production of superphosphates. The "Phosphat" Joint-Stock Co., with an established capital of 450,000 gold rubles, was formed some time ago to exploit the Yegorievsk deposit, which contains a reserve of 400,000,000 poods of phosphorite on a comparatively small area, while the reserves of the entire Yegorievsk deposit may be estimated at 3,500,000,000 poods. By increasing the number of excavating machines and modernizing the leaching equipment, now of a very primitive character, the annual output of phosphorites could be brought up to 10,000,000 poods, enough for the preparation of 2,000,000 poods of superphosphate a year. (A pood is 36.11 pounds.)

The Kineshma and Chernoreche plants, belonging to the "Phosphatotuk" Trust, can produce 3,000,000 poods of superphosphate during the year 1924–25. They have been designed in such a way as to enable each plant to expand its output to 4,000,000 poods a year.[55]

South Africa.—South Africa imports fairly large quantities of superphosphates. Supplies are now being drawn mainly from the Netherlands, as the following statistics of imports in 1922 and 1923 show:

South African imports of phosphates, 1922–1923

Country of origin	1922		1923	
	Pounds	Value	Pounds	Value
Netherlands	6, 833, 258	£13, 331	36, 434, 073	£56, 483
Germany	616, 194	398	4, 343, 600	5, 944
United Kingdom	7, 127, 472	13, 327	4, 024, 422	11, 038
Belgium	13, 476, 208	31, 556	3, 141, 092	7, 890
France	22, 204	98	------------	----------

The importations are usually in cargo lots. One of the latest quotations of Dutch superphosphates was 70s. per long ton c. i. f. Cape Town, analysis 17 per cent or better. Another recent quotation was 75s., analysis 17.1 per cent.[56]

Spain.—The phosphate-rock discoveries in Alhama de Murcia, Spain, have led to the finding of an important bed of first-grade lignite coal which is to be used by a 15,000-kilowatt steam-generating plant to be built near by. Geologists throughout Spain have been particularly interested in this new find, because phosphorus, potassium, and nitrogen occur in close relation with one another. The Madrid School of Mines has recently analyzed a number of samples from the newly discovered beds. The analysis shows a content of 20 per cent phosphate, 6 per cent potassium, and 1 per cent nitrogen. The deposit is estimated to contain approximately 10,000,000 tons of phosphate. The importance of this new bed to Spanish agriculture will be far-reaching. Spain was second in importance as a foreign market for Florida land-pebble phosphate in 1923, taking 92,326 long tons.[57] Spain was also second in 1924, taking 110,146 tons.

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[55] American Fertilizer, "The phosphate industry in Russia"; vol. 62, No. 11, May 30, 1925, p. 66.
[56] Poole, D. C., "South African market for phosphates"; Commerce Repts., Aug. 18, 1924, p. 435.

According to a published statement containing analyses of phosphate from Murcia, Spain, the rock is glauconitic with 20 to 30 per cent tricalcium phosphate and 7 per cent potassium. There are also white limestones containing as much as 31 per cent of phosphates, but these are not abundant.[58]

Spanish production of superphosphates shows a marked increase in 1923 as compared with 1922. In 1922, 461,530 tons, valued at 62,753,518 pesetas, was produced, whereas in 1923 the quantity produced was 561,853 tons, valued at 72,559,337 pesetas.[59]

Tasmania.—In Tasmania the Electrolytic Zinc Co. of Australia is now turning its attention to the manufacture of superphosphates and has launched a project for an output of 50,000 tons per annum. The superphosphate plant is part of the company's works at Risdon, near Hobart, and the first parcel of fertilizer has been manufactured. The project provides a suitable and profitable outlet for the sulphuric acid produced from the company's zinc concentrates.[60]

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[57] American Fertilizer, "Phosphate rock in the Province of Murcia, Spain"; vol. 62, No. 4, Feb. 21, 1925, p. 74.

[58] Menendez, L., y Puget, [Note on the formation, composition, and chemical properties of the phosphates of northern Africa and Spain], Bol. inst. geol. España, vol. 43, 1923, pp. 331–346; Rev. Géol., vol. 5, 1923, p. 177.

[59] Burke, J. G., "Spanish chemical production"; Bureau of Foreign and Domestic Commerce, Chem. Trade Bull. 52–A, Feb. 14, 1925.

[60] American Fertilizer, "Superphosphate industry in Tasmania"; vol. 61, No. 9, p. 57, Nov. 1, 1924; Min. Jour., London, p. 72, Jan. 17, 1925.

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CLAY

By JEFFERSON MIDDLETON

GENERAL CONDITIONS

Clay available for the manufacture of clay products. its largest use, is widely distributed in the United States, and there are clay-working plants in every State in the Union. The following tables of production represent chiefly the clay that was mined and sold as clay, or mined under royalty, and do not include the much greater quantity that was burned into clay products by the producers themselves. The quantity of clay sold thus is small compared with the total output and mainly includes clay used for making high-grade pottery and tile, paper, and refractory products. The values given for domestic production are f. o. b. at mines; for imports, at the principal markets of the countries from which the clay is exported; for exports, at the ports of shipment.

The general condition of the clay-mining industry was good on the whole in 1924. The total quantity and value of clay sold were the largest ever recorded and showed a gain of 7 per cent in quantity and 3 per cent in value compared with 1923. This increase may be in part due to more complete returns having been received, especially from those who mine clay under royalty, and is accounted for by the larger output of fire clay and miscellaneous or unclassified clay. The former, as its name indicates, is principally used as a refractory; the latter is composed largely of clay used for heavy-clay products, such as building and drainage materials. Every other kind of clay classified in this report decreased in quantity and value compared with 1923. The output of kaolin, the clay used in making high-grade pottery, porcelain, tile, paper, oilcloth, etc., decreased 3 per cent in quantity compared with 1923, but had practically the same value. The quantity for 1924 was, however, by far the largest recorded except that for 1923, which suggests that the output for 1923 was produced under an unusual demand that was not maintained in 1924, as the pottery industry slowed down somewhat in that year. The large production of 1923 may also have resulted in the accumulation of stocks in the hands of the consumers, which further reduced the demand. North Carolina and South Carolina showed the largest decreases in the production of kaolin. A small output of ball clay in Missouri in 1923 was erroneously credited to kaolin, which also accounts for part of the decrease. The recent opening of deposits in Florida and North Carolina by new operators gives promise of an increased capacity in 1925.

Ball clay, which is used principally with kaolin in bodies of high-grade ceramics, declined 14 per cent in quantity and 6 per cent in value as compared with 1923. The quantity for 1924 has been exceeded, however, by that of only four years—1923, 1918, 1917, and 1916. Slip clay, which increased greatly in 1923, decreased 31 per cent in quantity in 1924 but did not reach the level of any other year since 1919 except 1920. This clay, which for many years was used principally as a glaze on low-grade pottery, has in recent years been used as a binder in the manufacture of artificial abrasives. The production of slip clay is limited to Michigan and New York, though there are deposits in other States.

Stoneware clay also showed a large decrease in quantity and value—27 per cent in the former and 40 per cent in the latter. The term "stoneware clay" is a rather loose one, and much, if not all, of the fire and miscellaneous clays reported as having been sold for the manufacture of stoneware might properly be classed as stoneware clay; so the large decrease in this kind of clay compared with 1923 may be more apparent than real, though the quantity reported for 1924 is the smallest ever recorded.

Fire clay, which constituted about two-thirds of the total quantity of clay sold in 1924, on the other hand, made a record-breaking output, exceeding the war-time output of 1917 by 95,738 tons, or 4 per cent. The great use of this clay, as its name indicates, is in the refractory industries. Considerable quantities are also used in the stoneware, architectural terra cotta, plaster, and other industries. Miscellaneous clays embrace those used in many industries, the larger part being used in the manufacture of heavy-clay products, such as building and drainage materials. Clay included under this head is also used for cosmetics, filtering oil (after treatment), flower pots, insecticides, modeling, soap filler, softening water, taxidermy, etc.

UTILIZATION OF BENTONITE

A most interesting problem in the clay-mining industry is the utilization of the material occurring in large quantities in the far West and known under a number of names, such as ardmorite, bentonite, Death Valley clay, Denver mud, leverrierite, montmorillonite, otaylite, refinite, soap clay, wilkenite, etc. These are claylike materials, and are, perhaps, known more commonly as bentonite. It was first noticed by W. C. Knight, State geologist of Wyoming, and described by him in 1898. Since that time efforts have been made to utilize this peculiar material, and it has been used in a small way with more or less success as a water softener, in the manufacture of paper, soap, and cosmetics, for deinking newsprint, and in the filtering of oil. The largest use of this material at present is in California, where, under a patented process, the clay is used after chemical treatment in the decolorizing of oil. The results obtained are said to surpass those obtained by the use of fuller's earth. A comprehensive publication on this subject, recently issued by the Canada Department of Mines,[1] goes into considerable detail concerning the possible uses of bentonite as well as much other information regarding its distribution, character, origin, and history.

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[1] Spence, H. S., Bentonite: Canada Dept. Mines, Mines Branch, Ottawa, 1924, 36 pp.

PRODUCTION

Domestic clay sold in the United States, 1915–1924, by kinds

Year	Kaolin, china clay, and paper clay		Ball clay		Slip clay		Fire clay	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1915	141, 064	$781, 142	75, 348	$301, 910	7, 646	$18, 774	1, 570, 481	$2, 361, 482
1916	201, 157	1, 075, 730	89, 761	391, 152	14, 064	47, 939	2, 057, 814	3, 708, 009
1917	206, 334	1, 263, 799	107, 406	569, 240	16, 972	70, 505	2, 347, 972	5, 625, 095
1918	179, 694	1, 459, 529	89, 896	590, 631	13, 552	49, 898	2, 305, 033	5, 664, 064
1919	152, 828	1, 475, 681	65, 026	520, 849	5, 149	17, 556	1, 755, 331	4, 628, 605
1920	268, 203	2, 865, 407	69, 477	584, 611	9, 006	41, 519	2, 261, 915	7, 088, 049
1921	162, 726	1, 579, 163	54, 014	354, 565	4, 608	14, 841	1, 195, 861	3, 560, 373
1922	275, 675	2, 346, 095	76, 792	440, 877	4, 050	19, 405	1, 679, 220	4, 633, 486
1923	336, 803	2, 926, 255	97, 068	620, 978	8, 520	43, 609	2, 298, 163	6, 565, 899
1924	326. 611	2, 923, 965	83, 034	581, 966	5, 910	31, 023	2, 443, 710	6, 737, 063

Year	Stoneware clay		Brick clay		Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1915	134, 297	$126, 429	101, 968	$93, 863	332, 150	$288, 341	2, 362, 954	$3, 971, 941
1916	135, 958	137, 779	97, 164	76, 854	336, 672	314, 311	2, 932, 590	5, 751, 774
1917	81, 352	113, 839	93, 779	94, 703	260, 029	305, 365	3, 113, 844	8, 042, 546
1918	86, 800	147, 098	(a)	(a)	301, 386	421, 421	2, 976, 361	8, 332, 641
1919	60, 236	80, 367	(a)	(a)	236, 530	367, 573	2, 275, 100	7, 090, 631
1920	106, 350	229, 221	(a)	(a)	322, 100	467, 856	3, 037, 051	11, 276, 663
1921	86, 574	184, 540	(a)	(a)	242, 963	361, 818	1, 746, 746	6, 055, 300
1922	86, 866	164, 870	(a)	(a)	525, 097	725, 781	2, 647, 700	8, 330, 514
1923	81, 389	194, 358	(a)	(a)	612, 717	837, 814	3, 434, 660	11, 188, 913
1924	59, 194	117, 142	(a)	(a)	772, 660	1, 116, 377	3, 691, 119	11, 507, 536

[a] Included under "Miscellaneous clay."

Domestic clay sold in the United States in 1923, by States and kinds

State	Number of operators reporting sales	Kaolin, china clay, and paper clay		Ball clay		Fire clay	
		Short tons	Value	Short tons	Value	Short tons	Value
Alabama	10	----------	----------	----------	----------	77, 440	$108, 478
Arizona	(a)	----------	----------	----------	----------	----------	----------
Arkansas	(a)	----------	----------	----------	----------	167	1, 754
California	23	2, 049	$17, 237	1, 794	$7, 070	143, 089	239, 013
Colorado	17	----------	----------	----------	----------	146, 000	217, 258
Connecticut	(a)	----------	----------	----------	----------	----------	----------
Delaware	(a)	1, 282	17, 400	----------	----------	4, 000	12, 000
Florida	(a)	(a)	(a)	----------	----------	----------	----------
Georgia	15	123, 994	867, 808	----------	----------	4, 066	18, 427
Idaho	(a)	----------	----------	----------	----------	133	1, 297
Illinois	20	----------	----------	3, 625	16, 063	130, 340	245, 873
Indiana	14	147	1, 764	----------	----------	56, 718	90, 625
Iowa	5	----------	----------	----------	----------	----------	----------
Kentucky	19	----------	----------	31, 141	177, 579	70, 993	250, 320
Maryland	18	(a)	(a)	----------	----------	22, 152	99, 144
Massachusetts	5	----------	----------	----------	----------	406	2, 131
Michigan	4	----------	----------	----------	----------	----------	----------
Minnesota	(a)	----------	----------	----------	----------	----------	----------
Mississippi	3	----------	----------	----------	----------	1, 059	9, 380
Missouri	32	(a)	(a)	----------	----------	[b] 491, 211	[b] 1, 607, 927
Montana	4	----------	----------	----------	----------	11, 624	20, 033
Nebraska	(a)	----------	----------	----------	----------	255	965
Nevada	(a)	1, 000	10, 000	----------	----------	----------	----------
New Jersey	41	----------	----------	11, 280	89, 838	286, 145	1, 353, 566
New Mexico	5	----------	----------	----------	----------	3, 135	11, 939
New York	6	----------	----------	----------	----------	247	3, 211
North Carolina	6	23, 673	369, 398	----------	----------	----------	----------
North Dakota	(a)	8	58	----------	----------	21	326
Ohio	61	----------	----------	----------	----------	292, 216	681, 508
Oregon	(a)	----------	----------	----------	----------	----------	----------
Pennsylvania	72	60, 669	378, 712	----------	----------	412, 744	1, 172, 333
South Carolina	7	54, 748	451, 412	----------	----------	300	3, 000
South Dakota	(a)	----------	----------	----------	----------	----------	----------
Tennessee	11	----------	----------	49, 228	330, 428	55, 464	197, 661
Texas	10	----------	----------	----------	----------	3, 623	23, 391

[a] Included under "Undistributed."

[b] These totals include 10,617 tons of diaspore clay from Missouri, valued at $54,450.

Domestic clay sold in the United States in 1923, by States and kinds—Continued

State	Number of operators reporting sales	Kaolin, china clay, and paper clay		Ball clay		Fire clay	
		Short tons	Value	Short tons	Value	Short tons	Value
Utah	5					1,740	$12,700
Vermont	([a])	417	$3,682				
Virginia	3	([a])	([a])			1,036	3,796
Washington	8	([a])	([a])			5,524	19,549
West Virginia	5					76,315	158,294
Wisconsin	([a])						
Wyoming	3						
Undistributed	22	68,816	808,784				
	454	336,803	2,926,255	97,068	$620,978	[b]2,298,163	[b]6,565,899
Average value per ton			8.69		6.40		2.86

State	Stoneware clay		Miscellaneous clay [c]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Alabama			13,178	$9,941	90,618	$118,419
Arizona			30	360	30	360
Arkansas					167	1,754
California	5,096	$18,860	129,865	171,574	281,893	453,754
Colorado	([a])	([a])	([a])	([a])	190,250	272,276
Connecticut			703	1,139	703	1,139
Delaware					5,282	29,400
Florida					([a])	([a])
Georgia			190,961	190,961	319,021	1,077,196
Idaho					133	1,297
Illinois	29,997	49,750	1,933	2,233	165,895	313,919
Indiana			23,362	58,854	80,227	151,243
Iowa			4,666	4,730	4,666	4,730
Kentucky			61	122	102,195	428,021
Maryland	([a])	([a])	57,800	60,500	87,277	172,169
Massachusetts			952	4,725	1,358	6,856
Michigan			3,617	7,327	3,617	7,327
Minnesota			([a])	([a])	([a])	([a])
Missisippi	1,000	2,000			2,059	11,380
Missouri	([a])	([a])			495,797	1,624,789
Montana					11,624	20,033
Nebraska					255	965
Nevada			60	900	1,060	10,900
New Jersey	13,603	68,167	65,826	139,329	376,854	1,650,900
New Mexico					3,135	11,939
New York			8,000	40,490	8,247	43,701
North Carolina	([a])	([a])	([a])	([a])	23,793	369,518
North Dakota					29	384
Ohio	18,888	26,951	1,653	3,498	312,757	711,957
Oregon	271	1,037	830	1,796	1,101	2,833
Pennsylvania	7,373	17,571	36,606	58,266	517,392	1,626,882
South Carolina					55,048	454,412
South Dakota			400	4,000	400	4,000
Tennessee			649	1,462	105,341	529,551
Texas	79	147	121	335	3,823	23,873
Utah			2,510	2,600	4,250	15,300
Vermont					417	3,682
Virginia			([a])	([a])	14,303	128,071
Washington	([a])	([a])	4,817	8,916	10,491	29,040
West Virginia					76,315	158,294
Wisconsin			122	397	122	397
Wyoming			614	10,448	614	10,448
Undistributed	5,082	9,875	71,901	96,520	76,101	705,804
	81,389	194,358	[d]621,237	[d]881,423	3,434,660	11,188,913
Average value per ton		2.39				3.26

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[a] Included under "Undistributed."

[b] These totals include 10,617 tons of diaspore clay from Missouri, valued at $54,450.

[c] Includes ardmorite, bentonite, black-burning clay, montmorillonite, and shale; clay for architectural terra cotta, artificial abrasives, art pottery, asbestos products, blast furnaces, building brick, coke ovens, cosmetics, decolorizing oils, flower pots, foundries, gas retorts, greenhouse-glass coating, high-grade tile, hollow building tile, insecticides, medicines, modeling, paint, pencil leads, plaster and plaster products, roofing tile, sewer pipe, soap, and steel castings. Slip clay is also included in this column as a matter of statistical convenience.

[d] These totals include 8,520 tons of slip clay, valued at $43,609, or $5.12 a ton, from Michigan (630 tons, valued at $3,284) and New York (7,890 tons, valued at $40,325).

Domestic clay sold in the United States in 1924, by States and kinds

State	Number of operators reporting sales	Kaolin, china clay, and paper clay		Ball clay		Fire clay	
		Short tons	Value	Short tons	Value	Short tons	Value
Alabama	12			100	$400	66,293	$101,924
Arkansas	(a)					166	1,570
California	27	2,267	$19,157	3,793	14,683	220,196	372,869
Colorado	18					185,259	257,038
Connecticut	(a)					567	7,371
Delaware	3	(a)	(a)			(a)	(a)
Florida	4	(a)	(a)				
Georgia	18	135,504	975,422			21,977	49,300
Idaho	(a)					570	5,550
Illinois	20			3,850	20,000	94,773	193,711
Indiana	13					51,927	85,131
Iowa	4						
Kentucky	22			28,444	184,234	87,200	316,115
Maryland	15	2,050	3,362			30,414	107,991
Massachusetts	6					1,239	32,417
Michigan	5						
Minnesota	(a)						
Mississippi	3					(a)	(a)
Missouri	31			2,300	13,900	[b] 453,972	[b] 1,422,942
Montana	4					4,862	9,572
Nebraska	3					44	142
Nevada	3	1,084	10,611				
New Jersey	42			5,366	37,040	268,401	1,234,718
New Mexico	5					3,596	13,603
New York	6					170	1,700
North Carolina	5	16,858	277,418				
North Dakota	(a)	2	45			24	395
Ohio	60					249,094	552,476
Oregon	(a)					134	512
Pennsylvania	81	62,596	352,507			554,257	1,513,286
South Carolina	9	39,633	412,327			(a)	(a)
South Dakota	3						
Tennessee	14			39,181	311,709	67,119	242,267
Texas	9					2,967	19,477
Utah	6					6,405	29,333
Vermont	(a)	333	3,651			50	175
Virginia	5	(a)	(a)			(a)	(a)
Washington	7					4,317	16,142
West Virginia	4					63,106	128,553
Wisconsin	(a)						
Wyoming	3						
Undistributed	12	66,284	869,465			4,611	20,783
	482	326,611	2,923,965	83,034	581,966	[b] 2,443,710	[b] 6,737,063
Average value per ton			8.95		7.01		2.76

State	Stoneware clay		Miscellaneous clay [c]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Alabama			20,546	$18,621	86,939	$120,945
Arkansas					166	1,570
California			75,173	171,012	301,429	577,721
Colorado	686	$1,715	50,198	63,879	236,143	322,632
Connecticut			94	230	661	7,601
Delaware					5,710	66,254
Florida			(a)	(a)	50,247	692,657
Georgia	(a)	(a)	(a)	(a)	347,218	1,214,570
Idaho					570	5,550
Illinois	28,126	46,320	51,322	83,946	178,071	343,977
Indiana			50,315	37,031	102,242	122,162
Iowa			27,188	27,547	27,188	27,547
Kentucky					115,644	500,349
Maryland			53,878	54,578	86,342	165,931
Massachusetts			995	1,379	2,234	33,796
Michigan			9,332	14,041	9,332	14,041

[a] Included under "Undistributed."

[b] These totals include 9,252 tons of diaspore clay from Missouri, valued at $47,407.

[c] Includes adobe, ardmorite, bentonite, black-burning clay, montmorillonite, and shale; clay for architectural terra cotta, asbestos products, building brick, cement, cosmetics, decolorizing oils, draintile, foundries, gas retorts, high-grade tile, hollow building tile, insecticides, modeling, molding, oilcloth, paint, paper filler, pencil leads, plaster and plaster products, pottery, roofing tile, sewer pipe, soap, taxidermy, water softener, and wads. Slip clay is also included in this column as a matter of statistical convenience.

Domestic clay sold in the United States in 1924, by States and kinds—Continued

State	Stoneware clay		Miscellaneous clay [c]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Minnesota			21,545	$34,705	21,545	$34,705
Mississippi	([a])	([a])			2,195	7,619
Missouri	2,032	$3,032	1,266	1,583	459,570	1,441,457
Montana			5,410	5,531	10,272	15,103
Nebraska			13,048	14,030	13,092	14,172
Nevada			2,276	25,195	3,360	35,806
New Jersey	8,053	31,046	70,914	183,228	352,734	1,486,032
New Mexico					3,596	13,603
New York			5,778	29,538	5,948	31,238
North Carolina	108	108			16,966	277,526
North Dakota					26	440
Ohio	14,290	18,568	2,958	5,859	266,342	576,903
Oregon					134	512
Pennsylvania	3,962	12,711	41,103	64,204	661,918	1,942,708
South Carolina	([a])	([a])			41,544	421,713
South Dakota			500	3,850	500	3,850
Tennessee			39,636	48,115	145,936	602,091
Texas	195	429	23	100	3,185	20,006
Utah			4,014	4,034	10,419	33,367
Vermont					383	3,826
Virginia			([a])	([a])	14,466	121,249
Washington			15,456	19,557	19,773	35,699
West Virginia					63,106	128,553
Wisconsin			257	883	257	883
Wyoming			23,716	41,172	23,716	41,172
Undistributed	1,742	3,213	191,629	193,552		
	59,194	117,142	[d] 778,570	[d] 1,147,400	3,691,119	11,507,536
Average value per ton		1.98				3.12

[a] Included under "Undistributed."

[c] Includes adobe, ardmorite, bentonite, black-burning clay, montmorillonite, and shale; clay for architectural terra cotta, asbestos products, building brick, cement, cosmetics, decolorizing oils, draintile, foundries, gas retorts, high-grade tile, hollow building tile, insecticides, modeling, molding, oilcloth, paint, paper filler, pencil leads, plaster and plaster products, pottery, roofing tile, sewer pipe, soap, taxidermy, water softener, and wads. Slip clay is also included in this column as a matter of statistical convenience.

[d] These totals include 5,910 tons of slip clay, valued at $31,023, or $5.25 per ton, from Michigan (308 tons, valued at $1,749) and New York (5,602 tons, valued at $29,274).

Forty-one States reported clay sold as such in 1924, a decrease of one (Arizona). The leading 10 States in order of quantity of clay sold were Pennsylvania (18 per cent of the total of the United States), Missouri (12 per cent), New Jersey (10 per cent), Georgia (9 per cent), California (8 per cent), Ohio (7 per cent), Colorado (6 per cent), Illinois (5 per cent), Tennessee (4 per cent), and Kentucky (3 per cent). These 10 States reported 83 per cent of the total, and the first 5 reported 57 per cent. In all these States, except Georgia, fire clay is the leading kind reported and constituted from 46 per cent of the total in Tennessee to 99 per cent in Missouri.

PRODUCTION BY USES

Statistics showing the production of clay by uses are necessarily incomplete, as many clay miners do not know the purpose to which their clay is put, but it is believed that the figures given in the following table are sufficiently complete to serve as a guide in the study of the uses of domestic clays. In considering these figures it should be borne in mind that they represent chiefly the clay sold as clay by the original producers and do not include the much greater quantities of clay that are burned into clay products by those who mine their own clay.

Domestic clay sold in the United States in 1924, by uses, in short tons

Use	Kaolin, china clay, and paper clay	Ball clay	Slip clay	Fire clay (including fire-clay dust and clay for fire-clay mortar)	Stoneware clay	Miscellaneous clay	Total
White-bodied ware made from white-burning clays, including china, porcelain, general ware, chemical porcelain, porcelain electrical supplies, sanitary ware, etc	61, 744	38, 899		15, 789		871	117, 303
Art pottery	1, 259	1, 564		5, 677		1, 267	9, 767
High-grade tile	26, 293	23, 599		12, 705		355	62, 952
Chemical stoneware				825	500		1, 325
Stoneware	677			12, 450	51, 965	1, 254	66, 346
Enameling, as coating for granite ware, etc	10	1, 033	99	130			1, 272
Paper filler	118, 758	600				1, 054	120, 412
Paper coating	3, 672						3, 672
Rubber	23, 965			1, 300			25, 265
Oilcloth or linoleum	9, 668					75	9, 743
Paint filler or extender	10, 475			160			10, 635
Paint pigment	580					100	680
Architectural terra cotta	198			27, 543	3, 217	29, 847	60, 805
Asbestos products	1, 249	393		2, 002		2, 576	6, 220
Plaster and plaster products	6, 289			13, 300		33, 566	53, 155
Slip for glazing purposes			2, 180				2, 180
Cement	44, 895			28, 775		16, 934	90, 604
Kalsomine	2, 208						2, 208
Artificial abrasives		139	3, 631	695			4, 465
Crayons (for tailors' use, etc.)	640						640
Chemicals	902						902
Pencil leads (graphite)		1, 631				133	1, 764
Saggers	2, 269	9, 951		187, 472	387	630	200, 709
Pins, stilts, and spurs for potters' use	222	1, 656		5, 619			7, 497
Wads		1, 150		28, 723		158	30, 031
Gas retorts				2, 480	275	17	2, 772
Fire brick and block	3, 184			810, 458			813, 642
Fire-clay mortar, including clay processed for laying fire brick	113	700		329, 891	350		331, 054
Glasshouse pots		819		30, 060			30, 879
Glasshouse supplies, blocks, tiles, etc	167			11, 243			11, 410
Zinc retorts				30, 314			30, 314
Zinc condensers				17, 140			17, 140
Clay crucibles				27, 242			27, 242
Graphite crucibles and stoppers	19	31		1, 770			1, 820
Foundry use and steel works for cupola lining, etc	527			440, 589		41, 676	482, 792
Unspecified[a]	6, 628	869		399, 358	2, 500	642, 147	1, 051, 502
	326, 611	83, 034	5, 910	2, 443, 710	59, 194	772, 660	3, 691, 119

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[a] Includes clay for adobes, building brick, cosmetics, decolorizing oils, draintile, flowerpots, hollow building tile, insecticides, modeling, records (phonographic), roofing tile, sewer pipe, soap, taxidermy, wall paper, and water softener; also black-burning clay.

IMPORTS AND EXPORTS[2]

Clay imported for consumption in the United States, 1915–1924

Year	Kaolin or china clay			Common blue and Gross Almerode glass-pot clay		All other clays				Total	
	Short tons	Value		Short tons	Value	Unwrought		Wrought		Short tons	Value
		Total	Average			Short tons	Value	Short tons	Value		
1915	209, 132	$1, 152, 778	$5. 51	8, 864	$62, 569	23, 718	$90, 367	1, 343	$12, 433	243, 057	$1, 318, 147
1916	253, 707	1, 326, 684	5. 23	2, 501	12, 134	42, 478	163, 421	180	1, 994	298, 866	1, 504, 233
1917	241, 029	1, 315, 769	5. 46	88	709	26, 581	123, 439	338	2, 142	268, 036	1, 442, 059
1918	168, 100	1, 153, 240	6. 86	114	983	26, 984	163, 484	137	1, 087	195, 335	1, 318, 794
1919	180, 592	1, 965, 393	10. 88	4	133	23, 759	187. 550	498	4, 262	204, 853	2, 157, 338
1920	361, 800	3, 568, 677	9. 86	6, 837	157, 201	34, 252	272, 524	691	10, 267	403, 580	4, 008, 669
1921	162, 906	1, 546, 285	9. 49	4, 468	77, 217	41, 421	348, 870	120	2, 313	208, 915	1, 974, 685
1922	310, 136	2, 963, 420	9. 56	7, 323	84, 415	40, 624	327, 388	2, 566	29, 398	360, 649	3, 404, 621
1923	311, 298	3, 046, 191	9. 79	12, 999	121, 272	65, 379	481, 614	1, 676	21, 892	391, 352	3, 670, 969
1924	353, 124	3, 188, 454	9. 03	7, 059	62, 883	82, 562	706, 018	1, 322	18, 685	444, 067	3, 976, 040

Domestic clay exported from the United States, 1916–1924

Year	Fire clay		All other		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1916	45, 752	$144, 552	27, 941	$145, 970	73, 693	$290, 522
1917	54, 023	268, 093	29, 194	178, 764	83, 217	446, 857
1918	60, 206	333, 880	24, 348	192, 053	84, 554	525, 933
1919	37, 486	262, 501	30, 983	249, 571	68, 469	512, 072
1920	54, 125	393, 177	66, 035	775, 222	120, 160	1, 168, 399
1921	23, 666	177, 979	23, 779	183, 449	47, 445	361, 428
1922	24, 391	169, 664	[a] 23, 285	[a] 267, 908	47, 676	437, 572
1923	50, 055	303, 675	34, 840	329, 192	84, 895	632, 867
1924	41, 704	312, 676	31, 051	420, 040	72, 755	732, 716

[a] Includes 2,091 short tons of "kaolin, china clay, and paper clay," valued at $27,840. Similar exports are not separately classified for other years.

Imports of clay in 1924 increased 52,715 short tons, or 13 per cent, in quantity, and $305,071, or 8 per cent, in value, compared with increases of 7 and 3 per cent, respectively, in quantity and value of domestic clay. The imports of kaolin, which constituted 80 per cent of the total imports, increased 41,826 tons, or 13 per cent, in quantity, and $142,263, or 5 per cent, in value, compared with 1923. Unwrought clay, which probably includes ball clay, showed the second largest actual increase in quantity—17,183 tons—and the largest proportional increase—26 per cent. Common blue and Gross Almerode glasspot clay, which includes the highest grade of refractory clay, decreased 46 per cent in quantity and 48 per cent in value. Exports of clay in 1924 decreased in quantity and increased in value, compared with 1923. The decrease in quantity was 12,140 short tons, or 14 per cent, and the increase in value was $99,849, or 16 per cent. Fire clay, which constituted 57 per cent of the quantity and 43 per cent of the value of the clay exported in 1924, decreased 17 per cent in quantity but increased 3 per cent in value, compared with 1923; "all other" clay decreased 11 per cent in quantity but increased 28 per cent in value. The exports of clay in 1924, compared with 1920, the year of greatest quantity and value, decreased 39 per cent in quantity and 37 per cent in value.

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[2] Figures of imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

CARBON BLACK PRODUCED FROM NATURAL GAS

By G. B. Richardson

The production of carbon black from natural gas in the United States in 1924, reported to the division of mineral resources of the United States Geological Survey prior to its transfer to the Bureau of Mines, by 46 producers operating 69 plants in 9 States, amounted to 186,872,034 pounds—an increase of 35 per cent over the production in 1923 and nearly three times the output in 1922. Indicated deliveries in 1924 by producers of carbon black amounted to 129,521,602 pounds, contrasted with 102,376,381 pounds in 1923. On December 31, 1924, stocks of carbon black held in the custody of producers amounted to 95,671,246 pounds, an increase of more than 57,000,000 pounds over the corresponding stocks held on the last day of 1923. This record of overproduction was reflected in the average price per pound received by producers, 6.2 cents, which is the lowest that has been reported since the Government began to compile statistics of carbon black in 1919. The total value at the plants of the carbon black produced in 1924 was $11,564,936. The production of carbon black by States in 1923 and 1924 is shown in the following table, compiled by Miss H. Backus.

Louisiana in 1924 not only led all of the States in the production of carbon black, as it has done since 1921, but increased its relative standing by producing 77 per cent of the total output of the country as contrasted with 73 per cent in 1923. All of the carbon-black plants in Louisiana obtain their supply of gas from the Monroe field, and for 1924 reports were received covering the operation of 28 plants in Ouachita Parish, 6 in Morehouse, and 1 in Union Parish.

In West Virginia the output of carbon black has steadily decreased in recent years, and in 1924 the yield was only about one-half of that in 1919. This decreased production of carbon black, contrasted with the increased output of natural gas since 1921, follows the extension of pipe-line facilities and the rising price of natural gas. In 1924 reports were received from eight plants in Kanawha County, four in Boone, and one each in Doddridge, Harrison, Lincoln, Logan, Ritchie, and Roane Counties.

The output of carbon black in Texas in 1924, the second year of production in that State, was increased to more than five times that of 1923. The entire production was from four plants in Stephens County, the gas consumed coming from oil wells from which the supply of casing-head gas is reported to be greater than the demand for domestic and other industrial use. Statutes to prevent the wasteful utilization of natural gas, the production of which is under supervision of the State railroad commission, thus far have restricted to Stephens County the operation of carbon-black plants in Texas.

Kentucky's output of carbon black in 1924 was almost the same as in 1923 and was more than double the output of 1922. The production came from Floyd and Green Counties, for each of which reports were received from two plants, and from Lee and Whitley Counties, in each of which the operation of only one plant was reported.

Statistics of production of carbon black in Wyoming, Montana, Oklahoma, Pennsylvania, and Colorado, ranking in the order named, are grouped together to avoid revealing the operations of individual companies. In these States a single carbon-black plant is located in each of the counties named: Wyoming, Hot Springs and Fremont Counties; Montana, Fallon County; Oklahoma, Pittsburg County; and Pennsylvania, McKean County. Production of carbon black was reported for the first time in Colorado in 1924 from a plant operating in the White River gas field in Rio Blanco County.

There is a growing tendency to extract natural-gas gasoline from natural gas before its delivery to carbon-black plants, but figures showing the quantity of gas thus treated were not compiled prior to 1924. In that year 115,357,000,000 cubic feet, almost three-fourths of the total quantity of natural gas used in the production of carbon black, was reported to have been treated for the extraction of natural-gas gasoline, the percentages of gas so treated being largest in Louisiana, Texas, and Wyoming.

Carbon black produced from natural gas in the United States, 1923–24

State	Producers reporting	Number of plants	Quantity	Value at plant		Estimated quantity of natural gas used	Average yield per M cubic feet
				Total	Average		
1923			*Pounds*		*Cents*	*M cubic feet*	*Pounds*
Louisiana	29	35	101, 398, 881	$8, 415, 566	8. 3	82, 974, 000	1. 2
West Virginia	11	20	20, 038, 415	1, 983, 385	9. 9	13, 722, 000	1. 5
Kentucky	6	6	10, 058, 887	758, 091	7. 5	5, 906, 000	1. 7
Texas	3	3	2, 633, 013	183, 306	7. 0	2, 136, 000	1. 2
Wyoming	2	2	4, 133, 452	351, 718	8. 5	4, 358, 000	. 9
Oklahoma	1	1					
Montana	1	1					
Pennsylvania	1	1					
	[a] 47	69	138, 262, 648	11, 692, 066	8. 5	109, 096, 000	1. 3
1924							
Louisiana	31	35	144, 601, 550	8, 844, 609	6. 1	127, 812, 000	1. 1
West Virginia	6	18	15, 045, 448	1, 125, 733	7. 5	9, 572, 000	1. 6
Texas	4	4	13, 764, 014	882, 808	6. 4	9, 546, 000	1. 4
Kentucky	6	6	10, 135, 435	488, 533	4. 8	6, 189, 000	1. 6
Wyoming	2	2	3, 325, 587	223, 253	6. 7	3, 395, 000	1. 0
Montana	1	1					
Oklahoma	1	1					
Pennsylvania	1	1					
Colorado	1	1					
	[a] 46	69	186, 872, 034	11, 564, 936	6. 2	156, 514, 000	1. 2

[a] In counting the total number of producers a producer operating in more than one State is counted only once.

Summary of statistics of carbon black made from natural gas in the United States, 1919–1924

	1919	1920	1921	1922	1923	1924
Number of producers reporting	17	19	23	26	47	46
Number of plants	36	35	41	43	69	69
Quantity produced:						
Louisiana pounds	14,024,606	18,565,498	31,003,615	41,966,856	101,398,881	144,601,550
West Virginia do	29,925,614	26,659,469	25,073,000	20,095,481	20,038,415	15,045,448
Texas do	------------	------------	------------	------------	2,633,013	13,764,014
Kentucky do	8,106,721	6,096,925	2,697,075	4,306,875	10,058,887	10,135,435
Other States do			992,625	1,425,917	4,133,452	3,325,587
Total do	52,056,941	51,321,892	59,766,315	67,795,129	138,262,648	186,872,034
Produced by:						
Channel process do	(a)	(a)	(a)	(a)	116,696,891	162,257,725
Other processes [b] do	(a)	(a)	(a)	(a)	21,565,757	24,614,309
Stocks held by producers Dec. 31 pounds	(a)	(a)	(a)	2,434,547	38,320,814	95,671,246
Indicated deliveries by producers pounds	(c)	(c)	(c)	(c)	102,376,381	129,521,602
Value (at plants), of carbon black produced:						
Total dollars	3,816,040	4,032,286	5,445,878	5,819,618	11,692,066	11,564,936
Average per pound cents	7.3	7.9	9.1	8.6	8.5	6.2
Estimated quantity of natural gas used M cubic feet	49,896,000	40,599,000	50,565,000	53,629,000	109,096,000	156,514,000
Average yield per M cubic feet pounds	1.0	1.3	1.2	1.3	1.3	1.2

[a] Not reported.
[b] Including chain, disk, plate, ring, roller, "special," and thermatomic.
[c] Not available.

MAGNESIUM AND ITS COMPOUNDS[1]

By J. M. Hill and G. F. Loughlin

INTRODUCTION

For many years magnesite, the normal carbonate of magnesium, and dolomite, or high-magnesium limestone, were the only commercial sources of magnesian products in the United States, and their uses were sufficiently distinct for magnesite to be treated in a separate chapter of Mineral Resources and for dolomite to be included with limestone in the chapter on stone. Domestic magnesite, though a potential source of several products that were marketed chiefly east of Mississippi River, could not compete with foreign magnesite. During the World War, however, domestic magnesite and dolomite were both exploited to relieve the shortage caused by the curtailment of imports. Imports of magnesium chloride and sulphate and of metallic magnesium were also restricted, and this condition has led to the exploitation of domestic deposits and processes of manufacture. For these reasons the annual reviews of magnesium and its natural and manufactured compounds have been brought together in one chapter. The natural compounds include magnesite, dolomite, magnesium chloride, and magnesium sulphate. The manufactured compounds include the basic (or "technical") carbonate, calcined and dead-burned magnesite, dead-burned dolomite, and precipitated carbonate and sulphate derived from magnesite or dolomite, or from the crude sulphate.

Only the quantity of dolomite produced for its magnesium content is included here. Much larger quantities, either burned into lime or used as dimension, crushed, or pulverized stone, are included in the corresponding chapters on lime and stone.

The uses to which magnesite has been or may be put for most of which dolomite is also used, are as follows:[2]

In the manufacture of carbon dioxide and the sulphite process of paper manufacturing, in both of which magnesite has been displaced by cheaper dolomite or limestone; for refractory brick, shapes, crucibles, and furnace hearths, for which both dead-burned magnesite and dead-burned dolomite are used; for medicinal and toilet preparations, which are made from magnesite, dolomite, and natural magnesium sulphate; for pipe covering (mixed with asbestos), which in this country is probably all made from dolomite; for oxychloride

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[1] Figures of imports and exports compiled from the records of the Bureau of Foreign and Domestic Commerce by J. A. Dorsey, of the Bureau of Mines.

[2] These uses are reviewed in detail in U. S. Geol. Survey Bull. 355, 1908, and brief comment on magnesium chloride, sulphate, basic carbonate, metallic magnesium, and their uses are made in the chapter on magnesite in Mineral Resources of the United States for 1914, pp. 573-577.

(Sorel) cement, which is made from a mixture of calcined magnesite and magnesium chloride; as an absorbent in the manufacture of dynamite, a preventive of boiler scale where sulphurous waters are used, an accelerator in the vulcanization of rubber, fused magnesia for insulation at exceedingly high temperatures, and an adulterant of paint, all of which presumably call for calcined magnesite but are relatively unimportant in the consumption of domestic magnesite; and for metallic magnesium, which is made both from calcined magnesite and from magnesium chloride.

The section on magnesite has been prepared by Mr. Hill, and the other sections by Mr. Loughlin.

MAGNESITE

DOMESTIC PRODUCTION

In 1924 mines in the United States sold or treated the equivalent of 120,100 short tons of crude magnesite, valued at $1,041,300, a decrease of 18 per cent in quantity but of only 6 per cent in value as compared with 1923. This estimated value of the total crude magnesite sold or treated is determined by arbitrary valuations f. o. b. shipping points by the operators and the operators in the State of Washington place a very low value on crude magnesite. Of the total for 1924, 67,240 tons was from California and 52,860 tons from Washington. Most of the production in California was sold as caustic calcined magnesite, and most of that in Washington was sold dead-burned.

Five producers in California in 1924 operated at seven localities in six counties. In Washington two companies produced crude magnesite from deposits near Valley and Chewelah, in Stevens County.

Domestic magnesite (expressed as equivalent crude) sold or treated in the United States, 1919–1924

Year	Short tons	Value	Year	Short tons	Value
1919	156, 226	$1, 248, 415	1922	55, 790	$571, 745
1920	303, 767	2, 748, 150	1923	147, 250	1, 103, 700
1921	47, 904	510, 177	1924	120, 100	1, 041, 300

Of the domestic magnesite produced in 1924 only 1,570 tons was sold crude, for use largely in making chemicals; 26,520 tons (46 per cent) was sold as caustic calcined magnesite, for use as plastic material; and 29,830 tons (51 per cent) was sold dead-burned, for use as a refractory. These figures show that the material actually sold in 1924 amounted to 57,920 tons, which computed as crude magnesite was equivalent to 120,100 tons.

At the end of the year producers reported that 6,000 tons of crude magnesite was in stock on dumps, exclusive of large quantities of fines held at several dumps to be calcined eventually.

IMPORTS AND EXPORTS

Magnesite, not purified, imported into the United States, 1920–1924, by countries, in short tons

[General imports]

Country	1920	1921	1922	1923	1924
Africa, British South					([a])
Australia	38				
Austria	([a])	9, 496		1, 675	156
Belgium			50	101	54
Canada	6, 751	427	973	427	124
Czechoslovakia	4, 288	213	7, 781		
England	31	8	59	162	548
France					28
Germany	799	3, 884	20, 074	162	206
Greece	4, 480	4, 480	1, 120	5, 510	110
India, British		28	3, 297	7, 576	8, 011
Italy	23, 727	36, 121	94, 930	65, 262	54, 619
Mexico	560				
Netherlands	917	2, 914	5, 379	4, 406	5, 348
Poland and Danzig				1	
Rumania				24	
Scotland	213	90	595	729	1, 202
Straits Settlements	([a])				
Turkey in Europe	3, 952				
Venezuela	2, 576	1, 120			
	48, 332	58, 781	134, 258	86, 035	70, 406

[a] Less than 1 ton.

Magnesite, not purified, imported into the United States in 1924

[General imports]

Country	Caustic calcined		Dead-burned and grain (not suitable for manufacture into oxychloride cements)	
	Pounds	Value	Pounds	Value
Africa, British South [a]				
Austria	311, 740	$2, 989		
Belgium	108, 026	2, 056		
Canada [a]	77, 700	1, 163	158, 750	$2, 232
England	1, 096, 282	19, 576		
France	55, 115	788		
Germany	412, 481	4, 870		
Greece	219, 243	2, 383		
India, British	16, 022, 640	120, 812		
Italy			109, 237, 433	738, 953
Netherlands	10, 419, 763	153, 300	275, 643	4, 163
Scotland	2, 403, 863	45, 628		
	31, 126, 853	353, 565	109, 671, 826	745, 348

[a] Also crude from British South Africa amounting to 595 pounds, valued at $30, and from Canada 12,000 pounds, valued at $55.

Magnesite imported for consumption in the United States, 1920–1924

Year	Crude		Calcined, not purified	
	Short tons	Value	Short tons	Value
1920	33, 550	$406, 204	14, 780	$373, 165
1921	51, 993	525, 452	6, 788	250, 932
1922	73, 331	976, 283	72, 265	1, 267, 622
1923	5, 182	44, 081	72, 955	1, 022, 968
1924	6	85	64, 785	1, 172, 403

So far as known, Belgium, Germany, and the Netherlands produce no magnesite, the material shipped from those countries being mined in Austria. A large part of the magnesite imported from Italy probably also comes from Austria. With the resumption of activity in the steel industry the imports of magnesite have increased, because a large part of the imported material is dead-burned and is consumed at steel-making plants near the eastern seaboard. Most of the magnesite imported from India is the caustic calcined product in lumps, but the caustic calcined magnesite received from Greece is ground.

The average value of the calcined magnesite imported for domestic consumption in 1924 as indicated above was $18.10 a short ton, but the price was evidently fixed at the points of shipment in the producing country. The average price was so low because of the value assigned to imported caustic lump from India, which was $15.08 a ton. Of the calcined magnesite imported in 1924 for consumption 16,134 short tons was imported as caustic calcined, which was valued at $378,200 ($23.44 a ton), and 48,651 tons as dead-burned, valued at $794,203 ($16.32 a ton).

No exports of magnesite, either crude or calcined, were reported during 1924, but materials made of magnesia (including pipe and boiler coverings), having a weight of 3,120,070 pounds and valued at $243,579, were exported, as compared with 5,391,219 pounds, valued at $337,044, in 1923.

At the end of January there was reported in bonded warehouses 7,855 tons of magnesite, valued at $99,006. The quantity held in warehouses steadily increased until September, when 21,921 tons was reported in storage, valued at $145,715. From October to the end of the year the reported stocks of imported magnesite held in bonded warehouses was constant at 13,564 tons, valued at $37,693.

ANNUAL SUPPLY

The annual additions to supply of magnesite (which have been called consumption, although they do not include stocks held at consuming plants) consist of domestic production plus imports, for there are no exports of crude or calcined magnesite. The following table shows that the domestic producers have not been able to continue the increase in their contribution to the consumption by the aid of the tariff act of 1922.

Magnesite supply in the United States, 1920–1924, expressed as crude magnesite, in short tons

Year	Domestic	Imported [a]	Total	Percentage supplied by—	
				Domestic	Imported
1920	303,767	63,110	366,877	83	17
1921	47,904	65,569	113,473	42	58
1922	55,790	217,861	273,651	26	74
1923	147,250	151,092	298,342	49	51
1924	120,100	148,700	268,800	45	55

[a] Prior to 1924 a factor of 2 tons of crude to 1 ton of calcined was used in expressing imports as crude magnesite. For 1924 the factors used are 2 to 1 for imports from Italy and 2½ to 1 for other imports.

CAUSTIC CALCINED MAGNESITE

The domestic caustic calcined magnesite sold in 1924 amounted to 26,520 short tons (equivalent to about 59,370 tons of crude), of which mines in California produced 99 per cent. The largest producers of caustic calcined magnesite were C. S. Maltby, the Sierra Magnesite Co., and Harker & Hoff, of California, and the Spokane Plastic Magnesite Co., of Washington.

DEAD-BURNED MAGNESITE

The dead-burned magnesite sold in the United States in 1924 amounted to 29,830 short tons (equivalent to 59,160 tons of crude), as compared with 34,410 tons in 1923. Ninety per cent of the dead-burned output was produced in Washington, but some was produced in Napa and San Benito Counties, Calif. Dead-burned magnesite is used as a refractory, particularly in the steel industry, and most of it finds a market east of the Mississippi. Only by the aid of adequate tariff protection can domestic producers compete in the East with foreign competitors.

CRUDE MAGNESITE

In 1924 the quantity of magnesite sold crude by the producers was 1,570 tons, part of which was later caustic calcined for use as plaster. A very small quantity of crude magnesite was used by makers of high-grade refractory products. Information concerning magnesia chemicals is given on pages 135 to 137.

During the last few years very high grade refractories have been made in small quantities in the electric furnace by fusing magnesite. This product is made by the Carborundum Co., of Niagara Falls, and by the Vitrefrax Co., of Los Angeles.

A much smaller quantity of carefully selected magnesite is sold each year for the manufacture of metallic magnesium.

MARKET AND PRICES

The domestic market for magnesite of all grades in 1924 was not so good as in 1923 and producers still insist that they can not compete east of Chicago with foreign magnesite. Caustic calcined magnesite from India and from Greece is still sold cheaper in the Atlantic Coast States than domestic material of equal grade. A report of the Bureau of Foreign and Domestic Commerce [3] gives information concerning the foreign and domestic supply of magnesite and the markets for it.

Operators reported only small sales of domestic crude magnesite at $10 to $14 a ton, but most of the crude magnesite sold brought $13 a ton. So far as known, practically no imported crude magnesite was offered in the local markets in 1924.

Domestic caustic calcined magnesite was quoted [4] at $42.50 a ton, ground, f. o. b. plants in California, until late in February when the quotations rose to $45; they remained at that level until the first of November, when they dropped to $42.50 a ton. Producers reported sales of domestic caustic calcined magnesite at prices ranging from

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[3] Trade Information Bull. 184, Magnesite, 1924.

[4] Eng. and Min. Jour.-Press, vols. 117 and 118, 1924.

$29.50 to $33.50 a ton, but the bulk of the output sold at about $33.30 a ton. Magnesite from Greece was quoted throughout the year at $50 to $51 a ton c. i. f. New York.

Domestic dead-burned magnesite was quoted[4a] at $40 to $42 a ton delivered in sacks at Baltimore, Md., or Chester, Pa., and at $32 to $34 a ton in bulk at Chewelah, Wash. Producers reported the bulk of sales at $30.50 to $37 a ton f. o. b. California plants, and $25.25 a ton f. o. b. Washington plants.

Average value per short ton of domestic and imported magnesite, 1920–1924

Year	Domestic			Imported		
					Calcined, not purified	
	Crude	Caustic calcined	Dead-burned	Crude	Caustic calcined	Dead-burned
1920	$9.05	([a])	$31.11	$12.11	$25.25	
1921	10.65	$32.00	([a])	10.11	36.97	
1922	10.25	37.00	23.30	13.31	17.54	
1923	13.00	36.38	19.50	8.51	$28.10	$11.46
1924	13.00	33.30	26.40	14.17	23.44	16.32

[a] Data insufficient for calculation of averages.

Separate figures for imports of caustic calcined and dead-burned magnesite are not available prior to September 22, 1922, but the writer (J. M. Hill) estimates that the average values for dead-burned magnesite imported have been as follows: 1920, $10.17; 1921, $10.77; 1922, $12.92.

The companies in California and Washington named below produced magnesite in 1924, and two individual operators in California made a small production. Most of the producers sell the calcined products, though some crude can possibly be had from any of them.

California:
- California Magnesia Co. (old Harker & Hoff), Monadnock Building, San Francisco.
- C. S. Maltby, Humboldt Bank Building, San Francisco.
- Sierra Magnesite Co., 404 Balfour Building, San Francisco.

Washington:
- Northwest Magnesite Co. (Finch and other deposits), Crocker Building, San Francisco, Calif.
- Spokane Plastic Magnesite Co. (Double Eagle deposit), Terminal Building, Spokane.

The market for plastic magnesite was depressed during the summer; that for dead-burned magnesite was slow by reason of large importations and also because the steel industry was quiet. In August western producers received a freight rate reduction, which amounted to $2 a ton to Chicago, the new rate being 50 cents per 100 pounds. No adjustment of rates east of Chicago was allowed. In November, 1924, at the request of domestic producers the Tariff Commission reopened the question of an increase in import tariff. To date (August 1, 1925,) no decision has been made public.

[4a] Eng. and Min. Jour.-Press, vols. 117 and 118, 1924.

WORLD'S PRODUCTION

World's production of magnesite, 1916–1923, by countries, in metric tons

[Unless otherwise stated the quantities in this table represent crude magnesite mined]

Country	1916	1917	1918	1919	1920	1921	1922	1923
Australia:								
New South Wales	3,821	9,337	3,419	9,413	6,578	12,465	3,424	6,228
South Australia	169	152	447	277	188	175	585	168
Victoria	30	75	229	78	153	130	99	76
Western Australia	100	21	107	---------	---------	---------	---------	[a] 2
Austria-Hungary	[a] 81,771	[a] 106,783	(b)	(c)	[d] 120,347	[d] 160,823	[d] 281,247	[d] 180,292
Canada	51,981	58,755	52,434	13,564	28,159	8,447	7,873	12,079
Cyprus	15	(b)	(b)	(b)	(b)	(b)	895	284
Greece	199,484	162,938	39,340	62,408	71,870	60,132	55,471	57,783
India, British	17,922	18,493	5,947	17,401	14,577	20,338	19,582	19,748
Italy	18,252	31,070	28,882	35,930	33,850	9,410	8,700	12,474
Norway [e]	[a] 3,499	[a] 1,004	[a] 542	[a] 1,882	[a] 2,041	[a] 210	738	2,359
Russia	72,074	73,712	19,656	(b)	17,984	[f] 8,340	10,567	[g] 15,429
Spain	2,500	800	1,700	120	1,214	---------	303	---------
Union of South Africa	553	709	756	929	1,287	1,317	962	1,240
United States (sold or treated)	140,589	287,429	210,107	141,725	275,571	43,458	50,612	133,582
Venezuela (exports)	6,360	1,700	(b)	(b)	2,000	2,450	(b)	(b)

[a] Exports and computed on a basis of 2.1 tons crude to 1 ton sintered.

[b] No data available.

[c] Exports from the Republic of Austria for second half of 1919 were 8,523 tons crude and 24,268 tons dead-burned (sintered).

[d] Exports from Republic of Austria and computed on a basis of 2.1 tons crude to 1 ton sintered. In addition, 7,026 tons of caustic magnesia was exported in 1920, and 8,252 tons in 1921. In 1922 the companies operating reported 427,556 tons raw magnesite produced.

[e] In addition to exports of crude magnesite shown for 1916–1921, there was exported magnesite brick (magnesittegel) as follows: 1916, 519 tons; 1917, 341 tons; 1918, 355 tons; 1919, 357 tons; 1920, 710 tons; 1921, 337 tons.

[f] Computed on basis of 2.1 tons crude to 1 ton sintered.

[g] Operation year Oct. 1, 1922, to Sept. 30, 1923.

NOTES ON THE MAGNESITE INDUSTRY

Bain [5] in a general article on magnesite reviews the published data on magnesite deposits of the world and concludes:

Magnesite deposits which are being or have been worked can be divided into four types: (1) Magnesite as a sedimentary rock, (2) magnesite as an alteration of serpentine, (3) magnesite as a vein filling, and (4) magnesite as a replacement of limestone. Of these only the second and fourth are of economic importance at the present time. The most important and most complex is that which has been termed the replacement type.

Deposits of the replacement type in at least two cases (Styria and Quebec) are normal limestones replaced by magnesia-bearing solutions emanating from a granite magma. A similar origin seems to apply to the lesser-known Washington occurrence. The chemistry of the process as worked out from petrographical studies of the contact zones is outlined in the body of the paper and discussed at considerable length in an earlier paper[6] from which the conclusions are drawn.

The solutions were in the form of silicates when they reached the limestones. The solutes at a certain stage precipitated out as serpentine and talc rather than as anhydrous minerals as is usually believed to be the case. Almost simultaneously any anhydrous minerals already formed became hydrated.

Reaction between the limestones and dolomites and the silicate-bearing solutions formed magnesite or dolomite, depending upon whether the rock traversed by the solutions was a dolomite or a limestone.

The wollastonite formed during the reaction was carried away in solution as in the case of the silica in the formation of the magnesite veins in the better-known deposits in serpentine.

The sedimentary deposits seem to be formed in salt lakes chiefly by precipitation of the less soluble $MgCO_3$ formed by chemical reaction but probably helped by evaporation.

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[5] Bain, G. W., Types of magnesite deposits and their origin: Econ. Geol., vol. 19, 1924, pp. 412–433.

[6] Bain, G. W., Almandite and its significance in the contact zones of the Grenville limestone: Jour. Geol., vol. 31, 1923, pp. 657–666.

The vein deposits constitute a variety of the ordinary fissure-vein deposits of magmatic origin.

Deposits in serpentine are due to the alteration of serpentine by carbonated waters, seeming, in most cases, to be of magmatic origin. Transportation and selective precipitation are an important feature in forming workable deposits.

Magnesite from deposits of sedimentary origin or from deposits in serpentine is usually very uniform and free from objectionable constituents.

Magnesite from fissure veins is very ferruginous, due to the presence of $FeCO_3$.

Magnesite from replacement deposits is very variable and requires careful sampling. The quality of a shipment is the quality of the poorest piece in it.

DOMESTIC INDUSTRY

California.—The Ward property, near Piedra, Fresno County, was operated for a time during the year. C. S. Maltby produced dead-burned magnesite at the Nichellini deposit, Chiles Valley, Napa County. No magnesite was mined in 1924 from the deposits near Alta and Towle, in Placer County. In San Benito County, at the Sampson mine, under lease to C. S. Maltby, the 7 by 80 foot oil-fired rotary kiln installed in 1923 was in operation and a considerable tonnage of dead-burned and caustic magnesite was shipped.

The Standard mine, at Sampson Peak, owned by Hugo Fischel, was not reopened by the Superior Magnesite Co. No operations were reported at the magnesite deposits near Cima or Yermo, San Bernardino County.

The largest production of magnesite in California was made at the Red Mountain mine, near Livermore, Santa Clara County, operated by C. S. Maltby. The roasting equipment consists of four upright kilns for burning lump ore and a Scott furnace for handling fines. The ore is crushed to three-fourths inch in size. Pyrometer control of furnace heat at 2,100° F. is used in the Scott furnace.

No magnesite was produced in 1924 in Sonoma County, but the Granitite Manufacturing Co., of San Diego, did some development on the old Sonoma mine, near Guerneville.

A little ore was mined near Gustine, Stanislaus County.

The Sierra Magnesite Co., the second largest producer of magnesite in California, operated the Rex, Lindsay, and Tulare mines, near Lindsay and Magnesite, and the Gill ranch, at the north end of Porterville Hill, Tulare County. Crude magnesite is calcined at a well-equipped plant at Porterville in rotary furnaces with pyrometer control. The grades of caustic magnesite produced are made and sold under rigid specifications.

The California Magnesia Co. operated the Porterville Hill mines and produced caustic calcined magnesite in a vertical kiln on the ground. No magnesite was mined from the deposits near Exeter.

No magnesite was produced from the Gray Eagle mine in Tuolumne County.

Nevada.—No magnesite was mined in 1924 from the magnesite deposits in Clark County. It was rumored that the deposits were to be taken over by New York interests represented by Walker and Timmons.

Washington.—The Northwest Magnesite Co., operating the Finch, Keystone, and Midnight deposits, near Chewelah, Stevens County, is the largest producer of magnesite in the State and in 1924 mined more crude magnesite than any other company in the country. All of its output is dead-burned. Only one of the six electrically controlled rotary kilns was in operation in 1924, as the steel interests were overstocked with foreign magnesite for refractory products.

An excellent account of the plant of the Northwest Magnesite Co. was published by Young.[7]

A small amount of magnesite was mined at the Double Eagle, near Valley, and used for plastic products. It is reported [8] that a new company financed to the extent of $50,000 will work the Double Eagle property for lead ore as well as magnesite.

FOREIGN INDUSTRY

A report [9] from the Transvaal indicates that South Africa has sufficient magnesite to meet any demands that may arise in the near future. An extensive stockwork deposit in serpentine near the railroad at Kaapumuiden was worked in 1918 for the preparation of carbonic acid gas.

The magnesite producers of Austria, Czechoslovakia, and Hungary have formed an export sales syndicate [10] known as the Veitscher Magnesitwerke of Austria, which began to function in February, 1925. It will handle 85 per cent of the export business, practically all dead-burned magnesite, on a quota basis, with the exception of sales to the United States. This syndicate includes three Austrian, three Czechoslovakian, two German, and one English company, and it is reported that the Italian producers, while not officially in the syndicate, will operate more or less in harmony with it. The shipments of magnesite from Austria in the first nine months of 1924 totaled 53,000 metric tons, about two-thirds as much as in the period of 1923. Seventy per cent of the exports in 1924 were for shipment to the United States. The export price of dead-burned magnesite for United States delivery was $16 and for other delivery $20 a ton f. o. b. shipping point.

A general article on the occurrence of magnesite in Manchuria [11] and a description [12] of some deposits near Tshihchiao, midway between Dairen and Mukden, indicate that China has very large reserves of excellent crystalline magnesite, and should not have to look elsewhere for her supplies.

The Russian magnesite mines increased their production nearly 98 per cent, to 30,600 tons, in the period 1923–24.[13]

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[7] Young, G. J., A Washington magnesite plant; Eng. and Min. Jour.-Press, vol. 119, 1925, pp. 440–442.

[8] Magnesite, financing a mine: Mining Truth, Mar. 16, 1925, p. 12.

[9] Trevor, T. G., Base metal resources of South Africa: South Africa Min. Jour. of Industry, July, 1924.

[10] Commerce Reports, Mar. 9, 1925, p. 572.

[11] Niinomy, Kunitaro, Magnesite deposits of Manchuria: Econ. Geol., vol. 20, 1925, pp. 25–53.

[12] Nishihara, Hironao, An enormous magnesite deposit in Manchuria: Eng. and Min. Jour.-Press, vol. 119, 1925, pp. 488–499.

[13] Eng. and Min. Jour-.Press, vol. 119, 1925, p. 691.

DOLOMITE

DOLOMITE PRODUCTS

Dolomite sold for uses that are or have been also supplied by magnesite increased slightly in quantity in 1924. The approximate quantity of crude dolomite used in the manufacture of these products is as follows:

Crude dolomite sold in the United States for certain uses, 1918–1924, in short tons

[Includes dead-burned dolomite, basic magnesium carbonate, sulphite process of paper manufacture, and making of carbon dioxide]

1918	1, 413, 000	1922	1, 074, 000
1919	947, 000	1923	1, 226, 000
1920	1, 580, 000	1924	1, 239, 000
1921	499, 000		

DEAD-BURNED DOLOMITE

The principal dolomite product included in the category of dead-burned dolomite is that for refractory use. Some manufacturers of this product buy their stone, the sales of which are reported by the quarry companies in terms of crude stone; others quarry their own stone and report only in terms of dead-burned material. The two kinds of material are represented in the accompanying table, as well as the estimated total output in terms of dead-burned dolomite.

Dead-burned dolomite sold or used in the United States, 1918–1924

Year	Reported as raw stone		Reported as dead-burned		Total quantity calculated as dead-burned (short tons)
	Short tons	Value	Short tons	Value	
1918	490, 863	$560, 209	318, 896	$4, 097, 819	564, 000
1919	254, 787	394, 754	222, 036	2, 228, 602	349, 000
1920	612, 800	742, 020	316, 293	3, 732, 522	623, 000
1921	79, 480	85, 786	107, 664	1, 113, 010	147, 000
1922	146, 640	172, 251	348, 838	2, 813, 946	422, 200
1923	205, 890	249, 993	357, 642	3, 599, 116	460, 600
1924	309, 010	287, 137	328, 659	3, 209, 257	483, 200

BASIC MAGNESIUM CARBONATE

Basic magnesium carbonate, or "technical carbonate," used in "85 per cent magnesia" pipe and boiler coverings also decreased in output in 1924. Most manufacturers of this product buy their stone and do not report their output of finished product, but the crude stone sold for this purpose has been reported as follows:

Dolomite sold in the United States to magnesia works for manufacture of basic magnesium carbonate, 1918–1924

Year	Short tons	Value	Year	Short tons	Value
1918	90, 989	$126, 255	1922	53, 170	$79, 313
1919	62, 652	82, 619	1923	116, 410	146, 337
1920	57, 300	107, 107	1924	98, 160	129, 390
1921	32, 050	60, 648			

HIGH-MAGNESIUM LIME FOR SULPHITE PAPER MILLS

An estimate of the high-magnesium lime sold to sulphite paper mills is given below. Exact figures are impossible to obtain, as many lime producers who sell burned lime to paper mills do not specify the kind of paper mill. The quantity sold is expressed as burned lime.

High-magnesium lime sold in the United States to sulphite paper mills, 1918–1924

Year	Short tons	Value	Year	Short tons	Value
1918	88, 631	$726, 610	1922	70, 000	$650, 000
1919	83, 962	632, 930	1923	75, 000	750, 000
1920	121, 817	1, 347, 321	1924	70, 000	625, 000
1921	68, 992	711, 345			

CARBON DIOXIDE

Sales of crude dolomite for the manufacture of carbon dioxide, chiefly in California, are as follows:

Dolomite sold in the United States for the manufacture of carbon dioxide, 1918–1924

Year	Short tons	Value	Year	Short tons	Value
1918	16, 770	$22, 500	1922	38, 280	$58, 748
1919	16, 870	39, 895	1923	38, 460	52, 494
1920	33, 040	73, 671	1924	34, 600	57, 105
1921	34, 090	124, 984			

MAGNESIUM CHLORIDE

Magnesium chloride from brines or bittern waters was produced and sold by three companies—the Whitney Chemical Co. and the Oliver Salt Co. in California, and the Dow Chemical Co. in Michigan; but as more than 90 per cent was sold by the last-named company, the total sales are not disclosed. All of the material sold was classed as "commercial" chloride, 97 per cent or more pure. Its average value f. o. b. plant was 1½ cents a pound. If all the domestic and imported caustic calcined magnesite sold in 1924 could have been made into oxychloride cements during that year, the magnesium chloride required could readily account for the combined domestic sales and the imports for consumption.

Imports of magnesium chloride (other than anhydrous) declined considerably in 1924, but exceeded those of 1922 and previous years. The steady decline in price continued, however. Imports of the anhydrous chloride, on the other hand, more than doubled.

Magnesium chloride imported for consumption in the United States, 1920–1924

Year	Anhydrous			Total		
	Pounds	Value		Pounds	Value	
		Total	Average		Total	Average
1920	([a])	([a])		454, 334	$7, 098	$0. 016
1921	([a])	([a])		7, 365, 812	85, 727	. 012
1922	([a])	([a])		11, 403, 837	113, 618	. 010
1923	56, 110	$2, 703	$0. 048	23, 052, 385	190, 748	. 008
1924	136, 082	1, 820	. 013	15, 200, 433	85, 206	. 006

[a] Not separately classified.

MAGNESIUM SULPHATE

Natural magnesium sulphate was produced from epsomite in 1924 by the Epso Products Co. near Oroville, Wash., and by the American Magnesium Co. in southern California; from natural brines and bitterns by the Dow Chemical Co. at Midland, Mich., and the Oliver Salt Co. at Mount Eden, Calif.

The total sales of these companies are shown in the following table:

Natural magnesium sulphate sold in the United States, 1923 and 1924

Year	Pounds	Value	
		Total	Average
1923	14, 300, 000	$231, 000	$0. 016
1924	18, 839, 901	293, 167	. 016

Some of this magnesium sulphate was exported to Canada, but was not separately recorded by the Bureau of Foreign and Domestic Commerce. Imports of magnesium sulphate (Epsom salts) are shown in the following table:

Magnesium sulphate (Epsom salts) imported for consumption in the United States, 1919–1924

Year	Pounds	Value	Year	Pounds	Value
1919	17, 647	$1, 473	1922	25, 390, 734	$200, 203
1920	1, 803, 769	66, 944	1923	14, 455, 920	71, 566
1921	12, 519, 778	88, 153	1924	8, 881, 181	57, 579

MANUFACTURED MAGNESIUM SALTS

Statistics in the preceding pages deal with substances as they left the raw-material producer. Supplementary figures compiled biennially by the Bureau of the Census, which show the quantity and value of manufactured magnesium salts, are given below. The raw materials from which these salts were made may include dolomite, magnesite, crude magnesium sulphate, and crude magnesium chloride, but the quantities of these materials so used have not been reported. They are partly or wholly included in the figures of production already given.

Manufactured magnesium salts produced in the United States, 1921 and 1923

	1921			1923		
	Number of establishments	Pounds	Value	Number of establishments	Pounds	Value
Magnesium sulphate (Epsom salts)	12	29, 846, 756	$753, 822	12	41, 351, 136	$851, 103
Magnesium oxide	5	2, 648, 678	141, 340	5	13, 193, 112	707, 975
Magnesium chloride	------	------------	1, 304, 125	5	52, 065, 600	815, 398
Other—including metal, carbonate, fluosilicate, subacetate, etc.				------	------------	699, 790
	------	------------	2, 199, 287	------	------------	3, 074, 266

Imports of magnesium compounds not shown elsewhere in this report are given below:

Magnesium compounds imported for consumption in the United States, 1920–1924

Year	Calcined magnesia, purified		Carbonate, precipitated	
	Pounds	Value	Pounds	Value
1920	26, 859	$9, 093	14, 930	$1, 512
1921	35, 182	7, 593	18, 514	2, 061
1922	96, 792	15, 969	36, 254	3, 385
1923	141, 375	30, 802	1, 046, 990	55, 137
1924	101, 998	29, 252	481, 439	25, 333

METALLIC MAGNESIUM

The estimated sales of domestic metallic magnesium, 1921–1924, are given below:

Domestic metallic magnesium sold or used in the United States, 1921–1924

Year	Pounds	Value			
		Total	Average		
			Ingot	Powder	Sheet, wire, and castings
1921	48, 000	$86, 000	$1. 30	$2. 36	
1922	[a]60, 000	[a]89, 000	1. 60	1. 13	
1923	[a]125, 000	[a]155, 000	1. 25	1. 00	$3. 60
1924	[a]128, 000	[a]150, 000	[b]1. 07	[c]1. 10	3. 50

[a] Estimated.

[b] Prices ranged from as low as 90 cents in large contracts to $1.10 for small quantities. The published price established about Mar. 1, 1924, was $1.

[c] This price is an average for old powder sold in competition with old imported stocks and for new powder, manufacture of which began in October, 1924, at a sales price of $1.50 a pound.

As usual, only the American Magnesium Corporation, of Niagara Falls, N. Y., reported production and sales of domestic magnesium, made from calcined magnesite. One other domestic producer used magnesium chloride, and the Elektron Metals Corporation of America made castings from imported material during part of the year, mainly on an experimental basis. This company has suspended operations, and states that it is planning the establishment of a plant in Detroit.

Although total sales increased somewhat in 1924, production of new metal decreased slightly both at home and abroad. These conditions reflect a slow but sound progress in market development, especially for partly manufactured products, and a closer adjustment of domestic production to demand. Decreased production abroad is reported due to suspension pending introduction of a superior method of refining by which injurious impurities are practically eliminated. With this improvement in use a large increase in German production is planned.

The decrease in average value of ingot and increase in that of powder is noteworthy. The sales price of the new domestic powder,

$1.50, is about the same as that of new powder from Germany. Old powder made during the war period was sold at prices as low as 60 cents a pound. The publication of an average price for sheet, wire, and castings in the foregoing table marks the further growth of these products from the experimental stage.

The sales of castings, rods, sheet, wire, and tubing are beginning to represent a larger proportion of the total consumption. The sales of ingot, in spite of its considerable reduction in price, decreased slightly in 1924, owing to a slower growth in the demand for magnesium-aluminum alloys than had been expected.

Castings made by the American Magnesium Corporation during 1924 include aircraft parts, such as crank cases, oil pans, pistons, control pulleys, gasoline line fittings, bearings, instrument parts, control levers, hinges, steps, and supercharger castings; also microscope parts, lens holders, field glasses, parts for moving-picture machines and surveying instruments, golf-club heads, artificial limbs, impellers for air compressors, shuttles, and special bobbins.

IMPORTS

Magnesium imported for consumption in the United States, 1921–1924

Year	Pounds	Value	
		Total	Average
1921	39,913	$30,592	$0.77
1922	182,939	54,448	.30
1923	13,974	11,576	.83
1924	8,738	6,561	.75

Magnesium imported for consumption in the United States, 1923 and 1924, by classes

	1923			1924		
	Pounds	Value		Pounds	Value	
		Total	Average		Total	Average
Magnesium, metallic and scrap	11,381	$7,598	$0.668	3,299	$1,352	$0.410
Alloys (magnesium content)	510	572	1.122	1,637	641	.392
Powder (magnesium content)	1,496	1,983	1.326	2,975	3,930	1.321
Sheets, tubing, ribbons, wire, and all other articles of magnesium	587	1,423	2.424	827	638	.771
	13,974	11,576	.828	8,738	6,561	.751

Practically all the imports for consumption were withdrawals from warehouse. New imports in 1924 included 1,000 pounds of coarse powder, but their total was small.

DEVELOPMENT AND OUTLOOK

Interest in magnesium products and appreciation of their physical properties by potential consumers increased, but the general business depression during a considerable part of the year kept this interest from resulting in many additional sales.

The use of magnesium as a deoxidizer and desulphurizer continues to broaden. All manufacturers of nickel and monel metal depend on magnesium, and it is still important as a scavenger for brass and bronze.

Although the demand for magnesium-aluminum alloys in 1924 grew more slowly than expected, it is probable that as the properties of these alloys become better understood and as equipment for their fabrication and heat treatment is supplied, they will gradually replace pure aluminum. The demand for high-strength aluminum alloys in which magnesium up to 0.5 per cent is essential is gradually increasing. Some interesting properties are being shown by aluminum alloys containing a greater amount of magnesium. For example, an aluminum alloy containing about 4 per cent magnesium possesses electrical properties which make it useful for automobile speedometer cups. Lead hardened with about 0.04 per cent magnesium is attracting interest as a covering for telegraph and telephone cables.

A new alloy developed by the American Magnesium Corporation in 1924 is especially suitable for castings. It is very resistant to tarnish and corrosion and has physical properties superior to those of alloys previously made. Castings made from it have a tensile strength of 18,000 pounds per square inch and an elongation of 3 per cent. The Elektron Metals Corporation of America, which is closely related to the Chemische Fabrik Griesheim-Elektron of Germany, reports that in Germany a casting alloy has been commercially developed and placed on the market with a tensile strength of 28,000 pounds per square inch and an elongation of 5 to 8 per cent. It also reports that by its patented processes magnesium alloys can be cast in wet sand as easily and economically as aluminum can.

The new magnesium powder introduced in 1924 is characterized by 40 per cent more volume for a given weight than had been previously obtainable and is 99.9 per cent pure. Its efficiency in burning is correspondingly increased. It is receiving general approval and an increase in its consumption is expected in 1925.

Important progress has been made in the manufacture of sheet and plate. Magnesium sheet of excellent appearance and good physical properties is now produced with comparative ease, although still at high cost. The process requires special melting and alloying equipment, together with close temperature regulation and care in pouring the rolling billets. The American Magnesium Corporation is now rolling a magnesium-alloy plate suitable in size and strength for making the Liberty type of aircraft propeller. Other new uses of sheet and plate include lining material for airplanes and pilot boats for dirigibles, high-speed supercharger impellers and entrance buckets, radio diaphragms, and resonating disks for automobile horns.

Improvement in the manufacture of extruded rod and tubing has been made by the addition of drawing equipment which makes possible the manufacture of articles within definite tolerances and with improved physical properties. Products developed experimentally and not mentioned in the report for 1923 are special screws for automatic signaling devices, window frames, steering wheels for airships, and lightweight meter pointers.

The present demand for magnesium wire is limited to a few sizes. The most popular diameter is 0.025 of an inch. Magnesium ribbon 0.125 of an inch wide and 0.006 of an inch thick is standard. Ribbon, like powder, is now made 99.9 per cent pure. Considerable improvement has been made during the past year in the method of packing these commodities so as to make marketing easier. Degasification of radio tubes continues to consume the major part of the ribbon and wire sold, and manufacturers of thermos bottles are becoming interested in these products for a similar purpose. Chemical laboratories consume a little. A new use that may consume large quantities consists of winding magnesium ribbon spirally on an electrical resistor element and subsequently treating it under steam pressure. The magnesium coating is thereby converted to magnesium oxide with high thermal but low electrical conductivity.

Although the forging or hot pressing of magnesium continues to be one of the most promising developments, it is still in the experimental stage and no striking developments were reported in 1924.

The high cost of manufacture is still the greatest difficulty in the development of a market for magnesium. Total sales of commercial products are hardly sufficient to permit a substantial reduction in selling price; but the field is believed to be gradually broadening, and as certain demands assume commercial proportions, reductions in costs and in sales prices are to be expected.

SALT, BROMINE, AND CALCIUM CHLORIDE

By K. W. Cottrell[1]

SALT

PRODUCTION

The decrease in salt sold or used by producers in the United States during 1924 as compared with 1923 has been variously ascribed to a price war in the East, the importation of low-priced salt from Germany and the West Indies, drought, and lowered consumption due to slackness of trade in the fish-packing and other industries in the West.

Salt sold or used by producers in the United States, 1915–1924

Year	Short tons				Value[a]	
	Manufactured (evaporated)	In brine	Rock salt	Total	Total	Average
1915	2, 335, 823	1, 851, 199	1, 165, 387	5, 352, 409	$11, 747, 686	$2. 19
1916	2, 454, 836	2, 539, 717	1, 368, 353	6, 362, 906	13, 645, 947	2. 14
1917	2, 482, 564	2, 890, 588	1, 605, 025	6, 978, 177	19, 940, 442	2. 86
1918	2, 724, 203	2, 830, 600	1, 683, 941	7, 238, 744	26, 940, 361	3. 72
1919	2, 392, 290	2, 850, 639	1, 639, 973	6, 882, 902	27, 074, 694	3. 93
1920	2, 409, 924	2, 819, 916	1, 610, 189	6, 840, 029	29, 894, 075	4. 37
1921	1, 931, 243	1, 577, 335	1, 472, 576	4, 981, 154	24, 557, 966	4. 93
1922	2, 276, 683	2, 569, 042	1, 947, 124	6, 792, 849	27, 464, 838	4. 04
1923	2, 239, 872	2, 787, 239	2, 103, 602	7, 130, 713	27, 795, 941	3. 90
1924	2, 224, 555	2, 513, 853	2, 064, 707	6, 803, 115	25, 747, 048	3. 78

[a] The values are f. o. b. mine or refinery and do not include cost of cooperage or containers.

The total production of salt in the United States—reported from 101 plants in 1924—decreased 5 per cent in quantity and 7 per cent in value. The four leading States reported decreases in both quantity and value: New York, 5 per cent in quantity and 9 per cent in value; Michigan, 10 per cent in quantity and 9 per cent in value; Ohio, less than 1 per cent in quantity and about 1 per cent in value; and Kansas, 6 per cent in quantity and 22 per cent in value. Six States showed increases in quantity: California and Idaho, 6 per cent each; Louisiana, 7 per cent; West Virginia, 19 per cent; New Mexico, more than 200 per cent; and Porto Rico, well over 100 per cent. With the exception of West Virginia, these same States reported increases in value: California, 3 per cent; Idaho, 13 per cent; Louisiana, 21 per cent; and New Mexico and Porto Rico, over 200 per cent each. The value for West Virginia and Utah decreased 9 per cent and 1 per cent, respectively, but for Virginia it increased 37 per cent.

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[1] Statistics of imports and exports were compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Salt sold or used by producers in the United States, 1921–1924, by States

State	1921		1922		1923		1924	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
California	193, 618	$1, 043, 912	257, 790	$1, 211, 197	252, 465	$1, 327, 917	268, 112	$1, 361, 166
Idaho	----------	----------	21	240	31	310	33	350
Kansas	665, 968	3, 268, 661	759, 459	3, 849, 427	845, 163	3, 570, 135	794, 303	2, 781, 217
Louisiana	(a)	(a)	336, 852	1, 657, 708	359, 161	1, 808, 762	383, 104	2, 182, 797
Michigan	1, 427, 465	7, 439, 445	2, 005. 088	8, 693, 604	2, 127, 412	8, 684, 148	1, 918, 463	7, 864, 838
New Mexico	(a)	(a)	718	5, 747	525	5, 250	1, 700	17, 000
New York	1, 455, 014	6, 505, 041	1, 960, 867	7, 066, 409	2, 065, 842	7, 431, 155	1, 972, 808	6, 739, 597
Ohio	749, 349	3, 284, 952	1, 105, 757	3, 749, 564	1, 102, 387	3, 695, 248	1, 102, 214	3, 641, 585
Porto Rico	7, 418	24, 908	(a)	(a)	5, 875	8, 225	14, 466	29, 932
Utah	68, 874	491, 354	81, 909	387, 093	81, 449	468, 765	78, 577	463, 143
West Virginia	27, 964	320, 537	25, 188	283, 257	31, 589	284, 196	37, 561	258, 089
Undistributed [b]	385, 484	2, 179, 156	259, 200	560, 592	258, 814	511, 830	231, 774	407, 334
	4, 981, 154	24, 557, 966	6, 792, 849	27, 464, 838	7, 130, 713	27, 795, 941	6, 803, 115	25, 747, 048

[a] Included under "Undistributed."
[b] 1921: Hawaii, Louisiana, New Mexico, Texas, and Virginia; 1922: Porto Rico, Texas, and Virginia; 1923: Nevada, Texas, and Virginia; 1924: Texas and Virginia.

A comparison of the quantities and values of the varieties of salt manufactured in 1924 with those of 1923 shows that solar evaporated and pressed blocks manufactured from evaporated salt were the only varieties that increased in quantity. Salt in brine was the only variety that increased in value and this increase was very slight. All other varieties decreased in both quantity and value. The average value of all salt sold was 12 cents less than in 1923.

Salt sold or used by producers in the United States in 1924, by methods of manufacture

Method of manufacture	Short tons	Value	
		Total	Average
Evaporated in open pans or grainers	741, 056	$6, 721, 943	$9. 07
Evaporated in vacuum pans	1, 028, 895	7, 598, 168	7. 38
Solar evaporated	318, 884	1, 294, 093	4. 06
Pressed blocks from evaporated salt	135, 720	1, 059, 484	7. 81
Rock	2, 028, 083	7, 238, 159	3. 57
Pressed blocks from rock salt	36, 624	263, 260	7. 19
Salt in brine (sold or used as such)	2, 513, 853	1, 571, 941	. 63
	6, 803, 115	25, 747, 048	3. 78

The four leading States in the production of rock salt were New York, Kansas, Louisiana, and Michigan. These four States reported 97 per cent of the total quantity and 96 per cent of the total value of rock salt sold in 1924.

Rock salt sold by producers in the United States, 1915–1924

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average			Total	Average
1915	1,165,387	$2,299,894	$1.97	1920	[a] 1,610,189	[a] $7,048,315	$4.38
1916	1,368,353	2,665,270	1.95	1921	[a] 1,472,576	[a] 6,693,923	4.55
1917	1,605,025	3,897,595	2.43	1922	[a] 1,947,124	[a] 7,489,644	3.85
1918	1,683,941	5,684,661	3.38	1923	[a] 2,103,602	[a] 7,843,419	3.73
1919	1,639,973	6,224,920	3.80	1924	[a] 2,064,707	[a] 7,501,419	3.63

[a] Includes pressed blocks made of rock salt, as follows: 1920, 15,182 tons, valued at $172,211; 1921, 20,148 tons, valued at $169,244; 1922, 38,593 tons, valued at $245,174; 1923, 38,043 tons, valued at $281,302; 1924, 36,624 tons, valued at $263,260.

Evaporated salt sold or used by producers in the United States, 1923–1924, by States

State	1923		1924	
	Short tons	Value	Short tons	Value
California	245,015	$1,290,667	255,252	$1,309,726
Kansas	313,701	2,305,299	264,222	1,836,749
Michigan	806,165	7,346,432	804,385	6,587,768
New Mexico	525	5,250	1,700	17,000
New York	391,787	3,299,203	393,276	2,929,884
Ohio	301,309	2,884,360	310,625	2,841,063
Porto Rico	5,875	8,225	14,466	29,932
Utah	78,993	457,662	76,423	452,980
West Virginia	31,589	284,196	37,561	258,089
Undistributed [a]	64,913	504,887	66,645	410,497
	2,239,872	18,386,181	2,224,555	16,673,688
Percentage of decrease	1.6	0.5	0.7	9.3

[a] 1923: Louisiana, Nevada, and Texas; 1924: Idaho, Louisiana, and Texas.

The production of pressed blocks in the last seven years, as reported by the original producers of the salt and shown in the following table, does not represent the entire pressed-block industry, because some firms that do not produce salt are making pressed blocks from salt bought in the open market.

Pressed salt blocks sold by original producers of the salt in the United States, 1918–1924

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average			Total	Average
1918	94,150	$939,900	$9.98	1922	172,682	$1,554,429	$9.00
1919	119,510	1,358,757	11.37	1923	166,116	1,544,548	9.30
1920	129,224	1,515,041	11.72	1924	172,344	1,322,744	7.68
1921	117,739	1,275,483	10.83				

In 1924, as in 1923, almost 99 per cent of the total new supply of salt in the United States was of domestic production, and less than 2 per cent was imported.

Supply of salt for domestic consumption, 1919–1924, in short tons

Source	1919	1920	1921	1922	1923	1924
Domestic production	6,882,902	6,840,029	4,981,154	6,792,849	7,130,713	6,803,115
Imports	59,514	137,654	93,095	113,922	88,750	88,938
	6,942,416	6,977,683	5,074,249	6,906,771	7,219,463	6,892,053
Exports	119,416	139,272	109,563	134,989	125,529	144,945
New supply	6,823,000	6,838,411	4,964,686	6,771,782	7,093,934	6,747,108
Comparison with preceding year	−319,251	+15,411	−1,873,725	+1,807,096	+322,152	−346,826
Percentage of imports to new supply	0.9	2.0	1.9	1.7	1.3	1.3

IMPORTS AND EXPORTS

According to figures obtained from the Bureau of Foreign and Domestic Commerce and converted from pounds, as reported by that bureau, to short tons, the salt imported into and exported from the United States in the last 10 years has been as follows:

Salt imported for consumption in the United States, 1915–1924

Year	In bags, barrels, and other packages		In bulk		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1915	28,724	$196,593	93,602	$169,859	122,326	$366,452
1916	24,402	200,290	97,677	142,298	122,079	342,588
1917	13,472	139,339	51,450	140,796	64,922	280,135
1918	10,259	148,128	30,031	133,340	40,290	281,468
1919	9,676	137,627	49,838	105,077	59,514	242,704
1920	29,567	240,923	108,087	435,576	137,654	676,499
1921	38,374	333,282	54,721	197,749	93,095	531,031
1922	[a] 24,392	[a] 216,718	89,530	305,620	113,922	522,338
1923	[a] 36,185	[a] 240,970	52,565	142,288	88,750	383,258
1924	[a] 40,426	[a] 209,641	48,512	114,451	88,938	324,092

[a] Includes salt imported for curing fish, as follows: 1922, 2,252 short tons, valued at $5,549; 1923, 16,472 tons, $46,260; 1924, 27,096 tons, $61,581.

Salt imported into the United States, 1921–1924, by countries

[General imports]

Country	1921		1922		1923		1924	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
North America:								
Canada	1, 692, 000	$13, 560	1, 889, 300	$14, 547	3, 064, 500	$17, 736	3, 476, 843	$20, 554
Guatemala					500	26		
Mexico	18, 200	142						
Newfoundland and Labrador			115, 000	2, 800				
West Indies—								
British—								
Barbados					1, 012, 600	1, 153		
Jamaica			1, 034, 100	1, 379	3, 575, 700	4, 169	15, 422, 360	16, 548
Trinidad and Tobago			3, 265, 400	3, 668				
Other British	35, 761, 400	54, 271	59, 731, 400	77, 966	70, 100. 600	79, 781	50, 040. 105	57, 446
Dutch	9, 603, 200	12, 425	11, 016, 100	15, 713	3, 050. 600	4, 431	4, 094, 929	5, 181
French	62, 000	151			2, 390, 000	2, 785	180, 000	270
Virgin Islands of the United States	902, 800	1, 788						
South America:								
Chile			17, 300	99				
Europe:								
Belgium					440, 000	2, 070		
England	16, 676, 700	123, 999	14, 104, 100	105, 172	16, 448, 500	121. 253	15, 764, 896	121, 173
Germany	82, 712, 700	250, 614	110, 656, 000	274, 511	57, 453, 100	135, 959	40, 951, 106	72, 226
Italy	5, 846, 400	8. 347			10, 304, 000	10, 350		
Malta, Gozo, and Cyprus Islands							22, 400	86
Netherlands					561, 100	2, 503	896, 000	1, 200
Portugal	2, 912, 000	2, 850						
Spain	12, 494, 400	29, 597	25, 552, 600	27, 047	17, 277, 600	16, 396	35, 996, 400	29, 947
Asia:								
Hongkong	1, 100	11			200	57	280	24
Japan	500	19	3, 000	24	100	3		
Turkey	700	6						
Africa:								
Algeria and Tunis					11. 200, 000	5, 646	31, 997, 564	18, 626
French	17, 506, 000	33, 251						
Portuguese			243, 200	110			380, 800	110
	186. 190, 100	531, 031	227, 627, 500	523, 036	196, 879, 100	404, 318	199, 223, 683	343, 391

Salt exported from the United States, 1915–1924

Year	Short tons	Value	Year	Short tons	Value
1915	80, 474	$613, 847	1920	139, 272	$1, 901, 593
1916	84, 065	567. 441	1921	109, 563	1, 415, 471
1917	113, 993	1, 000, 773	1922	134. 989	1, 429, 172
1918	136, 783	1, 677. 577	1923	125. 529	1, 211, 226
1919	119, 416	1, 396, 625	1924	144, 945	1, 288, 376

Salt exported from the United States, 1921–1924, by countries

Country	1921		1922		1923		1924	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
North America:								
Bermuda	128, 284	$2, 128	182, 100	$2, 130	186, 530	$2, 350	223, 036	$2, 905
British Honduras	262, 212	2, 813	378, 984	3, 833	344, 563	3, 028	330, 945	2, 843
Canada	163, 278, 742	908, 753	208, 495, 592	928, 477	188, 954, 715	696, 709	217, 560, 848	754, 836
Central American States—								
Costa Rica	59, 380	1, 145	200, 676	1, 658	185, 474	2, 000	187, 533	2, 378
Guatemala	128, 559	2, 182	891, 415	5, 373	901, 808	5, 394	189, 319	3, 082
Honduras	1, 859, 679	23, 202	2, 377, 529	21, 294	2, 938, 624	27, 093	2, 122, 121	20, 318
Nicaragua	451, 557	8, 046	537, 263	7, 611	633, 060	8, 482	762, 409	8, 856
Panama	2, 236, 694	24, 069	1, 403, 816	13, 522	1, 802, 170	16, 676	1, 730, 796	15, 499
Salvador	1, 821	82	792	54	40, 096	274	948	22
Mexico	9, 305, 018	113, 261	9, 562, 151	94, 964	7, 375, 088	88, 071	10, 292, 980	97, 881
Miquelon, Langley, etc	576	11	1, 500	40	2, 564	78	1, 080	34
Newfoundland and Labrador	603, 490	5, 582	112, 200	554	678, 640	1, 135	91, 635	1, 107
West Indies—								
British—								
Barbados	724	25			100	4		
Jamaica	196, 438	1, 392	4, 436	88	4, 496	107	272, 136	1, 631
Trinidad and Tobago	6, 098	244	24	3			350	10
Other British			37, 369	421	15, 415	297	15, 472	297
Cuba	30, 965, 628	234, 577	41, 443, 389	268, 463	38, 895, 196	267, 960	51, 662, 620	292, 033
Dominican Republic	426, 830	7, 083	186, 315	4, 621	199, 527	5, 423	202, 357	4, 601
Dutch	50	5	96	5	440	23	620	35
French	8, 500	320	4, 396	122	934	27		
Haiti	8, 422	292	4, 678	197	4, 428	155	7, 749	294
Virgin Islands of the United States	12, 341	261	4, 716	76	34, 634	159	2, 852	86
South America:								
Argentina	20, 730	283	275	14	383, 216	2, 939	12, 500	163
Bolivia							1, 000	165
Brazil	528, 136	11, 130	70	11				
Chile			1, 460	63	705	24	1, 030	37
Colombia	55, 242	770	80, 150	1, 348	100, 380	1, 541	103, 332	2, 037
Ecuador			202	12			450	45
Guiana—								
British	280	4					96	2
Dutch	1, 500	60			14, 255	232		
Paraguay					1, 701	74	1, 200	44
Peru			6, 560	40			60	6
Uruguay					22, 000	118		
Venezuela	1, 440	29	2, 428	36	16, 102	307		
Europe:								
Denmark					4, 800	165		
England	10, 000	150	3, 969	114			142, 274	755
Esthonia			300	10				
France	1, 344	48			24, 000	210	8, 018	71
Germany			138	4			8, 625	73
Greece			8, 800	89				
Iceland and Faroe Islands	2, 400	95	3, 700	115			1, 000	36
Latvia			672	17				
Netherlands			2, 500	79			1, 526	19
Poland and Danzig					880	50		
Rumania			700	15				
Russia	3, 380	44	9, 924	127	764	28		
Spain			2, 240	11				
Yugoslavia and Albania							1, 400	50
Asia:								
Armenia and Kurdistan			785	37				
China	22, 093	1, 996	29, 759	2, 344	31, 522	2, 239	54, 115	3, 314
Kwangtung, leased territory	504	36	112	12	1, 530	88	3, 000	260
Ceylon			1, 160	125	1, 503	155	2, 750	273
Chosen	7, 147	425	4, 448	130	6, 520	188	1, 398	33
East Indies—								
British—								
India	6, 900	463	5, 121	242	5, 404	535	4, 522	412
Straits Settlements	1, 234	126	2, 387	255	168	18	696	70
Other British	3, 920	238						
Dutch	4, 213	262			384	44		

Salt exported from the United States, 1921–1924, by countries—Continued

Country	1921		1922		1923		1924	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Asia—Continued.								
Far Eastern Republic	3, 240	$280	7, 488	$264	20, 180	$168		
Hongkong	90, 574	3, 646	36, 853	2, 232	30, 687	2, 205	42, 700	$2, 652
Indo-China, French					1, 417	87		
Japan	6, 708, 380	28, 448	496, 750	1, 944	2, 167, 294	10, 762	159, 740	1, 013
Java and Madura			5, 736	556	3, 726	380	2, 220	183
Palestine and Syria			480	47				
Philippine Islands	72, 157	2, 734	185, 244	8, 989	2, 718, 770	17, 955	403, 938	11, 105
Russia	10, 810	278	2, 100	115				
Siam	1, 065	105	1, 359	147	3, 492	376	1, 550	155
Turkey	872	48						
Africa:								
Belgian Congo	2, 420	66	21, 000	268				
British Africa—								
South					2, 880	124		
West	265	7	214	8				
Canary Islands							4, 000	120
Egypt					375	14		
Liberia	23	1						
Portuguese Africa—								
East	1, 215	31			4, 560	50		
Other					399	18	274	8
Oceania:								
British—								
Australia	900, 918	17, 317	2, 530, 774	44, 137	1, 647, 691	31, 862	2, 812, 921	49, 063
New Zealand	486, 898	8, 261	444, 488	9, 157	364, 180	9, 153	98, 300	2, 815
Other British	14, 240	345	17, 170	316	11, 500	187	14, 750	298
French	217, 218	2, 169	230, 601	2, 236	261, 357	3, 412	296, 762	3, 887
Other	4, 446	103			4, 326	73	45, 150	464
	219, 126, 247	1, 415, 471	269, 977, 554	1, 429, 172	251, 057, 170	1, 211, 226	289, 889, 103	1, 288, 376

WORLD'S PRODUCTION

The quantities of salt produced in the chief countries of the world, during the five years 1919–1923 are shown in the following table compiled by Miss L. M. Jones, of the Bureau of Mines:

Salt produced in the chief countries of the world, 1919–1923, in metric tons

Country [a]	1919	1920	1921	1922	1923
North America:					
Canada	134, 536	190, 376	149, 374	164, 920	187, 773
Mexico [b]	67, 000	67, 000	67, 000	67, 000	67, 000
Panama [c]	([d])	826	677	826	([d])
United States—Rock salt	1, 487, 751	1, 460, 731	1, 335, 891	1, 766, 392	1, 908, 346
Other	4, 756, 280	4, 744, 406	3, 182, 912	4, 395, 945	4, 560, 494
West Indies—					
British—					
Bahamas	4, 270	[c] 1, 830	[c] 3, 200	[c] 2, 100	([d])
Ragged Island [c]	1, 260	509	([d])	([d])	([d])
Turks and Caicos islands [c]	51, 000	48, 394	([d])	46, 693	41, 320
Dutch [c]	8, 191	25, 524	17, 810	18, 459	11, 795
South America:					
Argentina [e]	140, 248	82, 464	75, 968	93, 698	([d])
Chile	29, 454	33, 951	39, 466	33, 743	38, 242
Colombia [b]	29, 000	29, 000	29, 000	29, 000	29, 000
Peru	27, 724	27, 172	26, 350	26, 126	26, 522
Venezuela	31, 479	([d])	([d])	([d])	([d])
Europe:					
Austria—Rock salt	498	2, 455	1, 815	2, 328	1, 520
Other	95, 434	79, 431	75, 236	85, 695	81, 771
Czechoslovakia	4, 944	30, 990	91, 200	128, 179	134, 080

[a] In addition to the countries shown in the table there are others in which salt is produced. For some of these, figures of production are available for years prior to those given in the table and may be found in earlier volumes of Mineral Resources.

[b] Estimated annual production.

[c] Exports.

[d] Data not available.

[e] Railway shipments.

Salt produced in the chief countries of the world, 1919–1923, in metric tons—Con.

Country	1919	1920	1921	1922	1923
Europe—Continued.					
France—Rock salt and salt from springs	649, 015	840, 001	793, 151	541, 340	1, 145, 440
Other	597, 495	432, 776	212, 251	238, 250	
Germany—Rock salt	1, 487, 849	2, 596, 825	1, 655, 753	2, 319, 896	1, 583, 978
Other	291, 719	335, 900	304, 466	360, 464	291, 518
Greece	28, 831	57, 285	65, 000	67, 500	59, 908
Italy—Rock salt	41, 313	46, 989	45, 440	49, 802	52, 754
Other	494, 435	675, 129	468, 151	740, 507	711, 892
Netherlands—Rock salt	5, 244	24, 857	25, 465	28, 334	26, 813
Poland	169, 203	245, 604	301, 612	295, 403	363, 307
Portugal [c]	81, 427	118, 368	([d])	([d])	([d])
Rumania	259, 167	246, 977	232, 818	285, 212	306, 612
Russia [f]	570, 000	579, 162	983, 676	789, 516	966, 456
Spain—Rock salt	37, 801	62, 647	37, 996	114, 400	98, 619
Other	443, 490	928, 898	475, 143	566, 480	617, 207
Switzerland	421, 000	448, 000	339, 000	64, 268	([d])
United Kingdom—					
Great Britain and Isle of Man—					
Rock salt	72, 545	86, 358	24, 525	26, 998	38, 494
Other	[g] 1, 743, 737	[g] 1, 985, 459	[g] 1, 302, 609	1, 756, 017	1, 860, 170
Ireland—Rock salt	19, 853	23, 460	11, 760	([d])	([d])
Other	([g])	([g])	([g])		
Yugoslavia	23, 400	23, 400	34, 922	43, 872	([d])
Asia:					
Ceylon	16, 229	16, 775	13, 952	39, 623	28, 834
China (including Kwangtung) [h]	2, 146, 000	2, 104, 000	2, 075, 000	[b] 2,000, 000	[b] 2, 000, 000
Chosen [i]	50, 690	54, 921	56, 000	45, 000	([d])
Cyprus [c]	1, 503	625	899	3, 022	778
India—					
British (including Aden)—					
Rock salt	208, 625	213, 207	150, 414	210, 639	121, 594
Other	1, 712, 866	1, 443, 079	1, 407, 881	1, 469, 804	1, 688, 150
Portuguese [b]	12, 000	12, 000	12, 000	12, 000	12, 000
Japan—Japan proper [j]	589, 005	543, 956	515, 103	665, 096	479, 908
Taiwan	73, 158	51, 976	101, 540	([d])	([d])
Philippine Islands	32, 000	62, 383	([d])	([d])	([d])
Siam [k]	63, 430	50, 737	29, 824	26, 542	32, 948
Africa:					
Algeria	27, 482	28, 169	18, 255	20, 208	25, 079
Belgian Congo [b]	80	80	80	80	80
British Somaliland [c]	516	504	906	1, 572	([d])
Egypt [c]	227, 229	225, 811	153, 651	186, 793	([d])
Eritrea [b]	20, 000	20, 000	20, 000	20, 000	20, 000
Mauritius [b]	1, 830	1, 830	1, 830	1, 520	1, 500
Nigeria [b]	400	400	400	400	400
Portuguese West Africa (Angola) [c]	1, 671	2, 746	2, 175	([d])	([d])
Tunis	16, 942	41, 086	32, 800	51, 950	72, 982
Union of South Africa	77, 265	80, 603	62, 033	75, 806	([d])
Oceania:					
Australia (South Australia) [l]	70, 284	72, 008	57, 399	49, 438	51, 093
Dutch East Indies	127, 423	135, 660	133, 522	170, 887	151, 582

[b] Estimated annual production.

[c] Exports.

[d] Data not available.

[f] Includes Asiatic Russia.

[g] Brine-salt production of Ireland included with that of Great Britain. Separate data not available.

[h] Estimated on approximate gross revenue under Salt Gabelle.

[i] In 1920, additions were made to the salt works which increased the annual capacity to 71,400 metric tons. (Financial and Economic Annual of Japan, 1922).

[j] Fiscal year ended March 31 of the year following that stated. The figures do not include output from salt beds which, though situated on Government beach lands, have no fixed areas.

[k] Exports for fiscal year ended March 31 of the year following that stated.

[l] The other States of Australia produce salt, but figures of production are not available.

BROMINE

The bromine sold by producers in 1924 increased over 140 per cent in quantity and over 300 per cent in value compared with 1923. The average value per pound increased 12 cents.

A large part of the output is not sold as bromine but in the form of potassium and sodium bromide and other salts. The figures given in the following table include the bromine content of these salts. The values given in the table are reported to the Bureau of Mines by the producers and represent averages for the year f. o. b. at the plants.

Bromine sold by producers in the United States, 1915–1924

Year	Pounds	Value		Year	Pounds	Value	
		Total	Average			Total	Average
1915	855, 857	$856, 307	$1. 00	1920	1, 160, 584	$745, 381	$0. 64
1916	728, 520	951, 932	1. 31	1921	711, 953	172, 759	. 24
1917	895, 499	492, 703	. 55	1922	1, 005, 174	150, 668	. 15
1918	1, 727, 156	970, 099	. 56	1923	842, 352	146, 176	. 17
1919	1, 854, 971	1, 234, 969	. 67	1924	2, 033, 804	594, 685	. 29

The wholesale price per pound of bulk bromine as quoted in the New York market in 1924, according to Chemical and Metallurgical Engineering, was 28 to 30 cents during the first six months of the year. From July 1 through November 3 the price stood at 34 to 38 cents; the week of November 10 it was 42 to 45 cents; November 17, 44 to 45 cents; the following week the maximum price was 46 cents; and bromine continued to sell at that rate—44 to 46 cents—until December 22, when the maximum price fell to 45 cents.

Bromine had not been imported into the United States for several years before 1921, when imports of 300 pounds, valued at $84, were reported by the Bureau of Foreign and Domestic Commerce. In 1922 the imports were 1,094 pounds, valued at $339; in 1923, 782 pounds, valued at $1,171; and in 1924, 37,318 pounds, valued at $8,958.

CALCIUM CHLORIDE

The calcium chloride reported in the following table is an original constituent of the natural brine produced in connection with the manufacture of salt and bromine in California, Michigan, Ohio, and West Virginia. The statistics cover the direct production of calcium chloride from mineral raw materials only. A further large output made by manufacturing processes used in the chemical industries is not reported.

Calcium-magnesium chloride from natural brines sold by producers in the United States, 1915–1924

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average			Total	Average
1915	20, 535	$130, 830	$6. 37	1920	27, 849	$539, 471	$19. 37
1916	27, 709	224, 997	8. 12	1921	23, 672	510, 723	21. 57
1917	30, 503	451, 480	14. 80	1922	33, 067	571, 326	17. 28
1918	26, 624	503, 452	18. 91	1923	44, 961	663, 384	14. 75
1919	26, 123	321, 596	12. 31	1924	58, 791	1, 164, 848	19. 81

Imports of calcium chloride in 1924 amounted to 3,996 short tons, valued at $54,542, according to the Bureau of Foreign and Domestic Commerce. In 1923, 3,232 tons, valued at $48,527, was imported, and from September 22 to December 31, 1922, 740 tons, valued at $8,563. Similar imports were not recorded separately prior to the new tariff.

Exports of calcium chloride are not shown separately.

SLATE

By G. F. LOUGHLIN and A. T. COONS

GENERAL CONDITIONS

The slate industry in the United States, which in 1923 was seemingly recovering from a period of depression, showed a further increase of 3 per cent in quantity in 1924. There was, however, a decrease of 2½ per cent in the total value of the slate sold. The sales in 1924 amounted to 727,700 short tons, valued at $11,776,016, compared with 707,100 tons, valued at $12,076,624, in 1923.

The slate industry falls into three groups—roofing slate, mill stock, and crushed slate for granules and "flour." The first two groups are closely connected and a strike in some of the quarries in the Pennsylvania district in 1924 materially decreased the sales of both these classes of products. Sales of crushed slate granules, on the other hand, continued to increase, as they have done since the beginning of trade in that product, and were responsible for the small increase in total quantity of slate sold. The average unit value, however, of both roofing slate and mill stock increased, whereas that of crushed slate decreased. Although roofing slate was reported in good demand during the greater part of the year, the total sales decreased 7½ per cent in quantity and increased but 1 per cent in value. The average value per square was $9.86 in 1924 as against $9.03 in 1923.

Sales of mill stock, which includes slate for electrical, and structural and sanitary uses, for grave vaults and covers, blackboards, bulletin boards, billiard-table tops, and school slates, amounted to 10,009,180 square feet, valued at $3,922,366, a decrease of 10 per cent in quantity and 6 per cent in value. All these mill products decreased in quantity in 1924 except that sold for vaults and covers. The decreased sales of electrical slate (17 per cent in quantity) were said to be due, aside from the strike, in part to substitution of manufactured material and in part to the use of stone imported for this purpose. The shortage caused by the strike was responsible for increase in the imports of stone.

Slate sold for structural and sanitary use decreased 5 per cent in quantity in 1924. Demand for blackboards and bulletin boards was said to be exceptionally good, although there was a decrease of 8 per cent in quantity of sales reported. This material is produced chiefly from the quarries in Pennsylvania, and many of the quarries were unable to supply it on account of the strike. Slate reported as sold for billiard-table tops decreased 35 per cent in quantity, and the number of pieces sold for school slates 20 per cent. Most of the school slates are exported, and the scarcity and cost of the raw material as well as unsettled political conditions in certain countries curtailed the sales in both 1923 and 1924. Slate sold for grave vaults and covers increased 25 per cent in quantity. There was a general trend toward increased wages as well as toward increased prices throughout the roofing-slate and mill-stock districts.

Slate for both roofing and mill stock meets keen competition from many materials, including slate granules used to surface manufactured roofing. For roofing and mill stock to hold their own with these competitive materials it has been found necessary to operate the quarries and to manufacture and sell the slate in such form and at such prices as will appeal to architects and builders as well as to purchasers of buildings. Roofing slate is now being marketed for its artistic contribution to the house, by colors and shapes being selected that correspond to the architecture and material used, as well as for its durability. Slate for structural and sanitary purposes, notwithstanding its satisfactory qualities, has not been used in many instances because its natural dark color does not harmonize with the designs or color effects desired. To overcome this difficulty, the Structural Slate Co. of Philadelphia has recently developed a finishing process by which structural slate is surfaced in white, light, or such colors as conform to any required condition. It is thought that use of the process will materially increase the demand for structural slate. In 1924 standardization of the sizes of the various slate products continued. Improved methods of production by means of modern equipment for quarrying, handling, and working up the material are gradually being introduced in the quarries and mills and are expected to counteract many of the present disadvantages of the labor situation and to enable the market to be supplied regularly and fully.

Sales of slate roofing granules and "flour" increased 11 per cent in quantity in 1924. Companies selling both granules and "flour" reported the demand for "flour" greater than for granules. Granules were first manufactured from the red and green slates of New York and Vermont, but are now made also from the green slates of Georgia and Tennessee and the gray and bluish-black slates of Maine, Maryland, Pennsylvania, and Virginia, although the plant at Monson, Me., was idle in 1924. Yellow-brown or rusty-colored granules are also being manufactured. In 1924 the crushed slate reported included 30,510 short tons of pulverized slate or "flour," valued at $176,246. Other stone, chiefly "greenstone" or altered diabase, crushed into granules in 1924 amounted to 77,370 tons, valued at $527,656.

The number of quarry companies reporting operation in 1924 was 123, or 3 more than in 1923. In New York and Vermont there are many small quarries intermittently worked on a small scale for roofing slate. The product of these quarries is generally sold with the output of some of the larger quarries, and much of it consists of "freak" or odd-colored slate of unusual size or thickness for use in special pieces of work.

As slate from many of the small producers is sold by the larger producing companies, the possibility of duplication of returns must be considered in the compilation of operators' reports. Special care has been taken in compiling the following figures to avoid duplication.

PRODUCTION

The following tables show sales of slate, by uses, from 1920 to 1924. In approximating the tonnage for the different slate products given in the second table a specific gravity of 2.75 has been used as the basis of calculation, and a thickness corresponding to an average for each product. The total quantity and value given for each use are the totals of the reports of the quarrymen (not the selling agents), and the value is that f. o. b. quarry or nearest point of shipment. It has been suggested that some of the mill stock is ultimately used for purposes other than those reported by the quarrymen, but the Bureau of Mines has no means of verifying this suggestion.

Slate sold by the producers in the United States, 1920–1924, by uses

Year	Roofing slate			Mill stock			Other uses [b] (value) [a]	Total value [a]
	Squares (100 square feet)	Value [a]		Square feet	Value [a]			
		Total	Average		Total	Average		
1920	396,230	$3,524,658	$8.90	9,910,000	$3,147,281	$0.32	$2,054,503	$8,726,442
1921	348,085	3,197,745	9.19	8,970,000	2,719,723	.30	1,404,538	7,322,006
1922	479,243	4,069,761	8.49	9,276,800	2,899,195	.31	2,207,828	9,176,784
1923	507,587	4,582,535	9.03	11,109,480	4,159,644	.37	3,334,445	12,076,624
1924	469,393	4,626,614	9.86	10,009,180	3,922,366	.39	3,227,036	11,776,016

[a] F. o. b. at point of shipment.

[b] Chiefly slate granules.

Roofing slate, mill stock,[a] and slate granules (including slate "flour") sold by the producers in the United States, 1923–24, by uses

Use	1923			1924		
	Quantity	Value [b]		Quantity	Value [b]	
		Total	Average		Total	Average
Roofing……squares	507,587	$4,582,535	$9.03	469,393	$4,626,614	$9.86
Approximate equivalent in short tons	171,300			158,420		
Electrical……square feet	2,182,890	1,754,717	.80	1,801,450	1,518,092	.84
Approximate equivalent in short tons	15,600			12,900		
Structural and sanitary……square feet	2,479,620	894,757	.36	2,346,050	951,964	.41
Approximate equivalent in short tons	17,730			16,640		
Grave vaults and covers……square feet	451,160	111,223	.25	566,160	142,167	.25
Approximate equivalent in short tons	6,450			8,100		
Blackboards and bulletin boards……square feet	4,415,710	1,186,864	.27	4,069,670	1,151,767	.28
Approximate equivalent in short tons	[c] 11,900			10,930		
Billiard-table tops……square feet	527,680	180,981	.34	341,200	131,028	.38
Approximate equivalent in short tons	3,770			2,400		
School slates……pieces	2,144,900	31,102	[d] 14.50	1,710,240	27,348	[d] 15.99
Approximate equivalent in square feet	1,052,420			884,650		
Approximate equivalent in short tons	1,550			1,200		
Granules……short tons	462,260	3,268,554	7.07	512,810	3,178,454	6.20
Other [e]……short tons (estimated)	16,540	65,891		4,300	48,582	
Total (quantities approximate, in short tons)	[c] 707,100	12,076,624		727,700	11,776,016	

[a] In 1923 the mill stock sold, including school slates, was 11,109,480 square feet, valued at $4,159,644; in 1924, 10,009,180 square feet, valued at $3,922,366.

[b] F. o. b. at point of shipment.

[c] Revised figures.

[d] Average value per thousand pieces.

[e] Includes slate sold for flagging (249,540 square feet, valued at $54,493, in 1923, and 187,730 square feet, valued at $47,437 in 1924), tombstones, waste slate, and other uses not specified.

Slate sold by the producers in the United States in 1924, by States and uses

State	Operators	Roofing		Structural and sanitary		Electrical		Other uses [a] (value)	Total value
		Squares (100 square feet)	Value	Square feet	Value	Square feet	Value		
California	1	([b])	([b])						([b])
Georgia	1							([b])	([b])
Maine	3	5, 313	$65, 552	20, 560	$15, 615	612, 150	$585, 004	$1, 370	$667, 541
Maryland	3	([b])	([b])					([b])	117, 137
New York	14	10, 974	170, 749					791, 527	962, 276
Pennsylvania	54	249, 450	2, 020, 986	2, 203, 040	857, 602	510, 850	366, 562	1, 912, 718	5, 157, 868
Tennessee	1							([b])	([b])
Vermont	41	168, 083	1, 986, 911	122, 450	78, 747	678, 450	566, 526	1, 378, 162	4, 010, 346
Virginia	5	31, 706	336, 627					([b])	[c] 336, 627
Undistributed		[d] 3, 867	[d] 45, 789					[d] 595, 569	[d,e] 524, 221
	123	469, 393	4, 626, 614	2, 346, 050	951, 964	1, 801, 450	1, 518, 092	4, 679, 346	11, 776, 016
Total, 1923	120	507, 587	4, 582, 535	2, 479, 620	894, 757	2, 182, 890	1, 754, 717	4, 844, 615	12, 076, 624

[a] For details see table of general sales on p. 153, and table on p. 157 for Pennsylvania.

[b] Included under "Undistributed."

[c] Exclusive of value of granules, etc., which is included under "Undistributed."

[d] Includes output of States entered as "([b])" above.

[e] Includes also value of granules, etc., for Virginia.

IMPORTS AND EXPORTS[1]

Value of slate imported for consumption in the United States, 1919–1924

1919	$691	1922	$2, 753
1920	4, 512	1923	16, 881
1921	2, 923	1924	32, 095

In view of the increased importation of this material, the following table showing imports by countries is given:

Slate imported into the United States in 1924, by countries

[General imports]

Country	Pounds	Value	Country	Pounds	Value
Canada	930	$1, 853	Sweden	6, 393	$127
England	215, 735	8, 794	Hongkong	48	17
Germany	97, 466	3, 849	Japan	70	50
Italy	1, 045, 003	15, 171			
Portugal	229, 522	2, 367		1, 595, 167	32, 228

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[1] The figures of imports and exports (except in second table on p. 155) were compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Roofing slate exported from the United States, 1923–24, by countries

Country	1923		1924	
	Number of squares	Value	Number of squares	Value
Canada	8,002	$74,357	7,207	$69,411
Mexico			24	116
Honduras	8	132		
Guatemala			3	55
West Indies:				
Bermuda	5	110		
Cuba	20	98	25	132
Trinidad and Tobago	108	1,031	240	1,439
Other British	135	1,296	16	79
Brazil	12	77		
Guiana, British			6	36
England	1	25		
Australia	72	657	167	1,567
Africa, British South	25	291		
New Zealand	74	706	477	4,587
	8,462	78,780	8,165	77,422

The following figures for exports of slate other than roofing were collected by the Bureau of Mines from shippers of the products named:

Slate other than roofing exported from the United States in 1924, by destination

Destination	Electrical		Billiard tables		School slates		Blackboards		Total value
	Square feet	Value	Square feet	Value	Cases [a]	Value	Square feet	Value	
North America:									
Canada [b]	[c] 25,980	[c]$23,414	370	$150	1,960	$26,426	128,180	$38,998	$88,988
Central America	1,080	1,015	430	182	300	3,031			4,228
Mexico	2,400	2,246			550	5,861			8,107
West Indies	2,890	3,637	220	90	1,230	12,872			16,599
South America	3,770	3,533	3,160	1,264	1,020	10,625			15,422
Europe	580	545	80	40	1,470	14,295			14,880
Asia	5,980	5,625	80	31	1,620	16,258			21,914
Africa	1,900	1,781			1,290	13,229			15,010
Oceania	3,290	3,078			1,100	11,268			14,346
	[c] 47,870	[c] 44,874	4,340	1,757	10,540	113,865	128,180	38,998	199,494

[a] Cases weigh from 130 to 165 pounds each; average is 135 pounds.
[b] There was also shipped to Canada 8,780 short tons of slate granules, valued at $54,400.
[c] Includes a small amount of structural slate.

REVIEW BY DISTRICTS

The slate report for 1922 gave for each section of the country a list of the producers operating slate quarries and a brief description of the slate produced and its use. As few changes have taken place among operators since 1922, their names are not repeated here.

Maine district.—In Maine where the chief product of the quarries is slate for electrical use, the demand was greatly curtailed in 1924. Both wages and prices advanced somewhat. The mill crushing slate granules in 1923 was idle in 1924.

New York-Vermont district.—New York and Vermont produce all of the colored slates used for roofing. Red slate is the chief product of the New York quarries but they also produce, with those of Vermont, the various green, purple, variegated, mottled, and "freak" slates at present in demand for artistic roofs. The output of the New York quarries is chiefly for roofing slate and granules. The sales of roofing slate in New York in 1924 were nearly two and one-half times as great as in 1923, and the quantity of granules sold was also somewhat larger. Some of the New York slate is sold for flagging. In 1924 the Amalgamated Slate Quarries Co., of Easton, Pa., took over the Superior, Red, and Dorrco quarries of the Laurel Slate Co. and the Dorrco Slate Co. in New York, and the Green Mountain Slate Co. quarries in Vermont.

The Vermont quarries produce roofing slate, mill stock, and slate granules. The colors are in a wide variety and combinations of green and purple generally classed as green, unfading green, unfading mottled green and purple, weathering green (sea-green), purple, variegated, and "freak" colors. There are also black and gray varieties. The granules manufactured are generally green. In 1924 Vermont reported the largest sales of electrical slate although they were not so large as in 1923. Purple slate is most used for this product.

The quantity of roofing slate sold in Vermont in 1924 was 1 per cent more than in 1923. Much of the roofing slate in both Vermont and New York is quarried and shaped by owners of small quarries which operate at irregular intervals. This slate is generally of unusual color and specially sized and is sold through operators of large quarries or through dealers. On account of the variety of colored slates found in the district much of the roofing slate commands a high price. Sales of slate granules in Vermont increased 23 per cent in quantity. The plant of the Vermont Milling Products Corporation, at Fairhaven, one of the larger producers of granules, was destroyed by fire in November, 1924, and according to reports it is not to be rebuilt.

Middle Atlantic States.—Pennsylvania furnishes practically all the slate in the Middle Atlantic district, but a small amount of roofing slate is generally produced annually in the "Peachbottom" region of Harford County, Md., and in New Jersey (idle 1924). Besides the roofing-slate quarries in Maryland mentioned in the report for 1922, a mill was erected in 1923 at Whiteford, Harford County, for the production of black roofing granules by the Staso Milling Co., of Chicago, Ill. Pennsylvania is the largest producer of slate exclusive of slate granules in the United States and it also produces a greater variety of slate products than any other State, although Maine and Vermont both outrank it in the production of electrical slate.

The demand for all slate products, except electrical slate, school slates, and billiard-table slate, was good in this State during 1924, but a strike in some of the Pen Argyl quarries in May, 1924, curtailed the output of roofing slate and affected the output of mill stock. Some of the quarries and mills increased wages and prices, but others did not. There were few changes in the operators of quarries. The sales of slate granules and "flour" in Pennsylvania increased 17 per cent in quantity. The Atlas Mineral Products Co. of Pennsylvania succeeded the Albany Co. at Albany, Pa., as a producer of slate "flour," and the J. Wilbur Co., of Providence, R. I., reported operations for this use at Greenawald, Pa. The Crushed Slate Co., at Bangor, Pa., constructed a mill on the property of the Bangor Central Slate Co. with the object of crushing slate to 1½ to 8 inches mesh, for use as a substitute for slag in built-up roofing. It is understood that the chips are attached flat to the under surface, so that walking on the roof does not puncture this under surface, and also that the chips do not wash off.

Slate sold by the producers in Pennsylvania in 1924, by counties and uses

County	Operators	Roofing slate			Mill stock			
		Squares (100 square feet)	Value		Structural and sanitary[a]		Electrical	
			Total	Average	Square feet	Value	Square feet	Value
Berks, Lancaster, Northampton,[b] and York	5							
Lehigh	12	26,834	$218,988	$8.16	37,280	$18,592	320,320	$192,149
Northampton	37	222,616	1,801,998	8.09	2,673,050	977,868	190,530	174,413
	54	249,450	2,020,986	8.10	2,710,330	996,460	510,850	366,562
Total, 1923	50	300,272	2,373,125	7.90	2,741,360	885,809	676,140	453,070

County	Mill stock—Continued				Other[c]	Total value
	Blackboards and bulletin boards		School slates			
	Square feet	Value	Square feet	Value		
Berks, Lancaster, Northampton,[b] and York					$487,779	$487,779
Lehigh	624,690	$126,608	794,450	$23,702	1,282	581,321
Northampton	3,439,830	1,023,202	90,200	3,646	[d] 107,641	[d] 4,088,768
	4,064,520	1,149,810	884,650	27,348	596,702	5,157,868
Total, 1923	4,415,580	1,186,326	1,076,220	31,102	658,238	5,587,670

[a] Includes slate for grave covers and vaults.

[b] For roofing granules.

[c] In 1923 includes 454,810 square feet of billiard-table material, valued at $148,138, and 68,550 short tons of granules and "flour," valued at $496,933, and in 1924, 288,950 square feet of billiard-table material, valued at $106,674, and 80,340 short tons of granules and "flour," valued at $487,779.

[d] Exclusive of value of roofing granules, which is included in first entry above.

Other districts.—There was little change in conditions at the quarries in Virginia. The Blue Ridge Slate Corporation, Esmont, reported a production of roofing slate as well as granules. Demand for roofing slate was generally good, and while wages were somewhat higher, prices were reported the same. There was an increase of 12 per cent in quantity of roofing slate sold. In Georgia and Tennessee the same quarries as reported in 1922 and 1923 were operated for granules and "flour." In California, a small quantity of roofing slate was furnished on a special order by the quarry at Placerville. A new development in California was, however, reported by the Milton Slate Co., at Milton, Calaveras County. Installation of machinery was reported at this quarry with the intention of starting operations in 1925.

SHIPMENTS

In 1923 and 1924 an attempt was made to collect statistics of the initial shipments of slate from the quarry districts to the different States. The collection of these statistics was undertaken chiefly at the request of the National Slate Association. The localization of the slate deposits in the most thickly populated part of the United States makes the matter of transportation to markets in other areas where the development of cities and towns is steadily increasing one of considerable importance to the slate trade. Transportation and freight rates have long been a retarding factor in the slate industry, and the better rates that have recently been obtained have been given as one of the main reasons for the increased activity of the slate trade. It would therefore seem that a statement showing the location and size of markets already obtained would suggest where other markets may be available. The total quantity of slate quarried annually is small, compared with that of many other mineral products, and no individual company has an output of considerable magnitude. In order, therefore, to facilitate the marketing of the product the large quarry companies and joint selling agencies act as distributers for many of the quarries and also as buyers for the slate trade. For this reason many of the quarry operators have no record of the ultimate destination of their slate.

As the statistics collected by the Bureau of Mines are obtained from the quarrymen rather than from the dealers and jobbers, the figures showing the distribution of the sales of slate were not very satisfactory for either 1923 or 1924, although some of the largest dealers cooperated with the Bureau of Mines by furnishing statements of the distribution of their sales for the year. Among the large jobbers of slate are the Vendor Slate Co., Easton, Pa., selling the roofing slate of many quarrymen in Pennsylvania and Vermont; John D. Emack Co., Philadelphia, Pa., distributer of roofing slate and other slate products from the New York, Pennsylvania, and Vermont quarries; the Natural Slate Blackboard Co., Pen Argyl, Pa., distributer of slate blackboards; the American Slate Works and the National School Slate Co., Slatington, Pa., distributers of school slates; and the Structural Slate Co., Pen Argyl, Pa., distributer of structural and sanitary slate, electrical slate, and slate for billiard-table tops. These companies act chiefly for the Pennsylvania quarries. In New York and Vermont the larger producing companies and other jobbers and dealers act as distributing agents.

The table below shows the shipments in 1924 by States of such products as were reported. They range from one-half to practically all of the total sales reported. The States are grouped to follow as closely as possible the territories covered by the different freight associations.

Distribution of slate products reported to the Bureau of Mines in 1924, grouped by general freight districts

Destination	Structural and sanitary (square feet)	Electrical (square feet)	Vaults and covers (square feet)	Black-boards and bulletin boards (square feet)	Billiard-table tops (square feet)	Granules (short tons)
New England States: Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island	298,180	184,680	98,940	281,100	700	35,700
Middle Atlantic States: New York, New Jersey, Pennsylvania, Delaware, Maryland, District of Columbia, Virginia, and West Virginia	806,020	401,450	359,630	1,171,080	220,360	189,310
South Atlantic States: North Carolina, South Carolina, Georgia, and Florida	22,390	9,290	11,210	102,060	----------	2,000
Northeastern Central States: Ohio, Indiana, Illinois, and Michigan	162,470	217,010	25,570	784,590	59,470	217,050
Southeastern Central States: Kentucky Tennessee, Mississippi, and Alabama	10,520	3,910	----------	84,940	----------	4,610
Northwestern Central States: Wisconsin, Minnesota, North Dakota, South Dakota, Nebraska, Iowa, Kansas, Missouri, and Colorado	89,250	26,570	10,010	650,120	15,460	7,830
Southwestern Central States: Oklahoma, Arkansas, Texas, and Louisiana	16,970	5,340	590	92,950	----------	4,500
Northern Mountain States: Montana, Idaho, and Wyoming	640	----------	----------	12,900	----------	--------
Southern Mountain States: Utah, Nevada, Arizona, and New Mexico	760	10	----------	29,400	----------	--------
Pacific Coast States: Washington, Oregon, and California	3,240	5,590	----------	189,630	----------	6,060
	1,410,440	853,850	505,950	3,398,770	295,990	467,060
Exports	([a])	[a] 47,870	----------	128,180	4,340	8,780
Total distribution reported	[a]1,410,440	[a] 901,720	505,950	3,526,950	300,330	475,840
Total sales	2,348,050	1,801,450	566,160	4,069,670	341,200	512,810

[a] Small amount of structural slate included with electrical.

These figures show structural slate, although shipped throughout the United States, at present is sold mostly in the New England and Middle Atlantic States, which are nearest to the source of the material, and the northeastern and northwestern Central States, which include the markets of Chicago, Cleveland, Cincinnati, Denver, Detroit, St. Paul, Minneapolis, St. Louis, and other large cities. Electrical slate is sold chiefly in the same groups of States as those for structural slate, the consumption being concentrated in the industrial centers of Boston, Schenectady, Philadelphia, Newark, Pittsburgh, and in Chicago, Detroit, Cleveland, and other cities of the Middle West. Slate for blackboards and bulletin boards is shipped throughout the United States, but slate for school slates is mostly exported. (See p. 155.) Slate for billiard-table tops finds its chief market in the Middle Atlantic and northeastern Central States. Sales of slate for grave vaults and covers are apparently confined at present chiefly to the Middle Atlantic, New England, and Central States. In the northeastern Central States, where considerable quantities of other slate products are marketed, sandstone quarried in Ohio is largely used for vaults and covers.

It is regretted that figures showing the shipments of roofing-slate shingles by States in 1924 were not complete enough for publication. Better results were obtained, however, than for 1923. Distributers of roofing-slate shingles were not willing to furnish figures of their shipments by States, but the figures that were received showed a wide range of markets. Shipments of less than 30 per cent of the output showed that slate shingles were shipped to 33 States. The greater part of the shipments reported went in 1924, as in 1923, to places east of Mississippi River and north of Ohio River, but small quantities went to California, Colorado, Georgia, Louisiana, Oklahoma, Texas, Utah, and Washington. Slate granules and "flour" were shipped mostly to plants manufacturing prepared roofing, near Boston, New York, Philadelphia, Cincinnati, Chicago, Detroit, and New Orleans. Some of the slate may not have been consumed in the States to which it was shipped, but may have been reshipped by dealers or distributers.

ASPHALT AND RELATED BITUMENS

By K. W. Cottrell

PRODUCTION

In 1924 the production of asphalt and related bitumens was reported by 48 operators, of whom 18 produced native asphaltic materials, 15 manufactured asphalt from petroleum of domestic origin only, 10 from petroleum of foreign origin, and 5 from both domestic and foreign petroleum.

Native asphalt and related bitumens sold at mines in the United States, 1915–1924

[Value f. o. b. mine]

Year	Short tons	Value	Year	Short tons	Value
1915	75,751	$526,490	1920	198,497	$1,213,908
1916	98,477	923,281	1921	296,412	1,985,583
1917	81,604	773,424	1922	327,792	2,253,180
1918	60,034	780,808	1923	400,236	2,885,631
1919	88,281	682,989	1924	562,367	3,958,339

Domestic asphalt sold at mines and refineries in the United States, 1919–1924, by varieties

[Value f. o. b. mine or refinery]

Variety	1919		1920		1921	
	Short tons	Value	Short tons	Value	Short tons	Value
Petroleum asphalt [a]	614,692	$8,727,372	700,496	$11,985,457	624,220	$9,048,221
Bituminous rock	53,589	262,309	132,353	531,134	284,037	1,788,715
Gilsonite	(b)	(b)	56,204	548,776	10,066	178,224
Wurtzilite			(b)	(b)	(b)	(b)
Other bituminous substances [c]	34,692	420,680	9,940	133,998	2,309	18,644
	702,973	9,410,361	898,993	13,199,365	920,632	11,033,804

	1922		1923		1924	
	Short tons	Value	Short tons	Value	Short tons	Value
Petroleum asphalt [a]	805,145	$10,385,925	995,654	$13,060,174	1,158,456	$14,305,007
Bituminous rock	298,047	1,629,440	365,601	2,190,009	525,831	3,294,059
Gilsonite	29,693	622,107	34,425	681,622	35,907	603,620
Grahamite	(b)	(b)	------	------	60	450
Ozokerite	------	------	10	2,000	300	36,000
Wurtzilite	(b)	(b)	200	12,000	269	24,210
Other bituminous substances [c]	52	1,633	------	------	------	------
	1,132,937	12,639,105	1,395,890	15,945,805	1,720,823	18,263,346

[a] From domestic petroleum only.
[b] Included under "Other bituminous substances."
[c] 1919: Gilsonite, grahamite, impsonite, and wurtzilite; 1920, 1921, and 1922: Grahamite and wurtzilite.

Native asphalt and related bitumens sold at mines in the United States, 1919–1924, by States

[Value f. o. b. mine]

State	1919		1920		1921	
	Short tons	Value	Short tons	Value	Short tons	Value
California	[a] 3, 614	$15, 037	(a b)	(a b)	(a b)	(a b)
Oklahoma	[c] 4, 323	18, 187	[c] 7, 522	$45, 898	[c] 25, 573	$87, 587
Utah	[d] 33, 992	406, 610	[d] 63, 522	659, 176	[d] 10, 371	190, 808
Other States [e]	[f] 46, 352	243, 155	[a] 127, 453	508, 834	[a] 260, 468	1, 707, 188
	88, 281	682, 989	198, 497	1, 213, 908	296, 412	1, 985, 583

State	1922		1923		1924	
Alabama			[a] 1, 200	$4, 200	[a] 8, 498	$29, 743
California	(a b)	(a b)	[a] 2, 945	11, 780	[a] 3, 731	14, 088
Kentucky	(a b)	(a b)	[a] 184, 300	1, 468, 396	[a] 274, 743	2, 386, 557
Missouri					[a] 300	3, 150
Oklahoma	[c] 47, 597	$164, 035	[a] 25, 800	150, 100	[a] 17, 961	80, 825
Texas	[a] 152, 567	558, 274	[a] 151, 356	555, 533	[a] 220, 598	779, 696
Utah	[d] 29, 704	623, 207	[g] 34, 635	695, 622	[g] 36, 536	664, 280
Other States [e]	[a] 97, 924	907, 664				
	327, 792	2, 253, 180	400, 236	2, 885, 631	562, 367	3, 958, 339

[a] Bituminous rock.

[b] Included under "Other States."

[c] Bituminous rock and grahamite.

[d] Gilsonite and wurtzilite.

[e] 1919: Illinois, Kentucky, and Texas; 1920 and 1921: California, Kentucky, and Texas; 1922: California and Kentucky.

[f] Bituminous rock, grahamite, and impsonite.

[g] 1923: Gilsonite, ozokerite, and wurtzilite; 1924: Gilsonite, grahamite, ozokerite, and wurtzilite.

Asphalt manufactured in the United States from petroleum and sold at refineries, 1915–1924

[Value f. o. b. refinery]

Year	From domestic petroleum		From foreign petroleum	
	Short tons	Value	Short tons	Value
1915	664, 503	$4, 715, 583	388, 318	$3, 730, 436
1916	688, 334	6, 178, 851	572, 387	6, 018, 851
1917	701, 809	7, 734, 691	645, 613	7, 441, 813
1918	604, 723	8, 796, 541	597, 697	9, 417, 818
1919	614, 692	8, 727, 372	674, 876	7, 711, 510
1920	700, 496	11, 985, 457	1, 045, 779	14, 272, 862
1921	624, 220	9, 048, 221	908, 093	11, 761, 358
1922	805, 145	10, 385, 925	1, 242, 163	13, 899, 407
1923	995, 654	13, 060, 174	1, 378, 722	16, 840, 045
1924	1, 158, 456	14, 305, 007	1, 920, 915	21, 710, 793

Asphalt and asphaltic material manufactured in the United States from petroleum and sold at refineries, 1924, by varieties

[Value f. o. b. refinery]

	From domestic oil		From foreign oil		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Solid and semisolid products of less than 200 penetration: [a]						
Asphalt—						
Paving	392, 827	$5, 435, 225	836, 512	$10, 487, 105	1, 229, 339	$15, 922, 330
Roofing and waterproofing	315, 434	4, 358, 912	537, 997	5, 782, 456	853, 431	10, 141, 368
Mineral rubber	4, 352	126, 534	8, 710	176, 380	13, 062	302, 914
Other solid and semisolid products	50, 831	601, 084	120, 426	1, 162, 724	171, 257	1, 763, 808
	763, 444	10, 521, 755	1, 503, 645	17, 608, 665	2, 267, 089	28, 130, 420
Semisolid and liquid products of more than 200 penetration: [a]						
Flux—						
Paving	109, 218	1, 098, 380	73, 935	689, 209	183, 153	1, 787, 589
Roofing and waterproofing Other	7, 121	90, 014	232, 449	1, 956, 492	239, 570	2, 046, 506
Other liquid products	61, 945	585, 554	295	2, 171	62, 240	587, 725
	178, 284	1, 773, 948	306, 679	2, 647, 872	484, 963	4, 421, 820
Road oil	216, 728	2, 009, 304	110, 591	1, 454, 256	327, 319	3, 463, 560
Grand total	1, 158, 456	14, 305, 007	1, 920, 915	21, 710, 793	[b] 3, 079, 371	36, 015, 800

[a] Definitions:

Paving asphalt.—Refined native asphalt and asphaltic cement, fluxed and unfluxed, produced for direct use in the construction of sheet asphalt, asphaltic concrete, asphalt macadam, and asphalt block pavements, and also for use as joint filler in brick, block, and monolithic pavements.

Roofing and waterproofing asphalt.—Asphalt and asphaltic cement used in saturating, coating, and cementing felt or other fabric and in the manufacture of asphalt shingles.

Mineral rubber.—Asphalt and asphaltic cement used by the rubber industry.

Other solid and semisolid products.—Asphalt and asphaltic cement used as dips and in the manufacture of insulating material, acid-resisting compounds, putty, mastic, and briquets and not included in the preceding definitions.

Flux.—Liquid asphaltic material used in softening native asphalt or solid petroleum asphalt for paving, roofing, waterproofing, and other purposes.

Other liquid products.—Petroleum asphalt used in the manufacture of saturant, paint, varnish, or other coating, exclusive of fuel oil and not included in the preceding definitions.

Road oil.—Residual asphaltic oil used for surface treatment.

[b] The difference between this total and the total of the monthly refinery reports in Petroleum Refinery Statistics, 1924, is due to slight differences in classification at some of the refineries.

NATIVE ASPHALT AND RELATED BITUMENS

Native asphalt and related bitumens produced in the United States in 1924, including bituminous limestone and sandstone rocks, gilsonite, grahamite, ozokerite, and wurtzilite, amounted to 562,367 short tons, valued at $3,958,339. This was an increase of 41 per cent in quantity and 37 per cent in value. Records of the production of these asphalts kept by the United States Geological Survey since 1882 show a yearly output of 3,000 tons until 1886, when there was an increase of 500 tons. In 1887, 4,000 tons were reported. In 1888 production increased from 4,000 to over 50,000 tons. In succeeding years it ranged from 41,000 tons in 1890 to 99,000 tons in 1909—the largest recorded production until 1920. In 1918, 60,000 tons were reported and since that time the trend of production has been steadily upward.

In the quantity of native asphalt and related bitumens reported for 1924 Kentucky, Texas, Utah, and Oklahoma maintained their ranks of 1923. Alabama forged ahead of California, and Missouri entered the list with a small production of bituminous rock. With the exception of Oklahoma the quantity produced in all the States increased, ranging from over 600 per cent in Alabama to 49 per cent in Kentucky, 46 per cent in Texas, 27 per cent in California, and 5 per cent in Utah. The value increased correspondingly, except in Kentucky, where the increase was 63 per cent. Production in Oklahoma decreased 30 per cent in quantity and 46 per cent in value.

Gilsonite.—Gilsonite, particularly valuable for manufacture of paints and varnishes and used also in manufacture of rubber substitutes, was produced in Utah. The production in 1924 increased 4 per cent in quantity, but decreased 11 per cent in value from the preceding year.

Wurtzilite.—Wurtzilite, frequently sold under the trade name of elaterite, was mined in Utah, and is used in the manufacture of roofing material, waterproof felt, rubber substitutes, building paper, and paving materials. Its production increased 35 per cent in quantity and doubled in value in 1924.

Ozokerite.—Ozokerite, a mineral wax or native paraffin, is used largely in the manufacture of phonographic records, also as a source of illuminating gas, oils, and other substances, as an insulator of electricity, and as a covering to protect metal surfaces against moisture, acids, or alkalies. The production which was all from Utah, increased from 10 tons in 1923 to 300 tons in 1924. The average value decreased from $200 to $120 a ton.

Bituminous rock.—Bituminous rock used for road building was produced in all the States that reported, except Utah. The output increased 44 per cent in quantity and 50 per cent in value in 1924.

MANUFACTURED ASPHALT

In the production of asphalt manufactured from domestic petroleum in 1924, California, with 7 operators, ranked first in both quantity and value; Texas, with 3 operators, ranked second; and Illinois, with 4 operators, ranked third. These three States produced 79 per cent of the total quantity of asphalt manufactured from domestic petroleum. The total sales of asphalt products made from domestic petroleum in 1924 increased 16 per cent in quantity and 10 per cent in value over those of 1923. Of these products paving asphalt increased 31 per cent in quantity and 22 per cent in value; roofing and waterproofing increased 1 per cent in quantity but decreased 3 per cent in value; mineral rubber increased 1 per cent in quantity but decreased 73 per cent in value; and road oil increased 22 per cent in quantity and 33 per cent in value.

The total sales of asphalt products manufactured from foreign oil increased in quantity and value 39 and 29 per cent, respectively. Each variety of product sold reflected this increase; paving asphalt increased 37 per cent in quantity and 32 per cent in value; roofing and waterproofing 29 per cent in quantity and 15 per cent in value; and road oil over 100 per cent in quantity and about 70 per cent in value.

ICHTHYOL

No production of domestic ichthyol was reported for 1924. The property of the Meadows Chemical Corporation, of Durant, N. Y., which manufactured ichthyol from material obtained near Burnet, Tex., was purchased in 1923 by the Dayton Chemical Co. This company plans to manufacture ichthyol and preparations containing ichthyol. Its plant is now in course of construction. The imports of ichthyol and ichthyol substitutes in 1924, according to the Bureau of Foreign and Domestic Commerce, amounted to 9,300 pounds, valued at $17,058.

IMPORTS AND EXPORTS[1]

Native asphalt and bituminous rock imported into the United States, 1921–1924, by countries

[General imports]

Source	1921		1922		1923		1924	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
North America:								
Canada	18	$634	52	$2,251	147	$3,358	1,275	$17,105
Mexico			3	25	3	95		
West Indies—								
British—								
Barbados	101	14,760	36	6,590	126	16,260	20	2,430
Trinidad and Tobago	75,305	754,503	85,480	721,891	97,252	688,221	84,282	666,669
Other	896	4,200	1,120	11,200	560	14,850	134	600
Cuba	371	7,020	113	2,711	282	7,933	346	9,203
Dominican Republic					15	2,545		
South America:								
Argentina					8	768		
Colombia	18	1,556	(a)	5	18	468	55	627
Venezuela	51,676	343,535	37,449	247,920	37,320	246,572	73,309	490,895
Europe:								
Belgium	2	30	(a)	3	3	124		
Denmark			49	1,516				
France			39	948				
Germany	140	1,889	312	4,481	1,393	18,009	902	12,123
Italy					2	1,010	11	1,322
Netherlands	2	25					(a)	5
Spain					8	208		
Switzerland					(a)	95	1	233
United Kingdom—								
England			6	920	7,496	79,145	77	1,236
Ireland					2	245		
Asia:								
Palestine and Syria							7	711
Philippine Islands	(a)	5	(a)	2				
Turkey	6	1,133						
	128,535	1,129,290	124,659	1,000,463	144,635	1,079,906	160,419	1,203,159

(a) Figures for quantity not available.

Ozokerite and other mineral waxes imported for consumption in the United States, 1915–1924

Year	Pounds	Value
1915	2,795,256	$210,019
1916	3,007,676	196,185
1917	899,405	90,510
1918	1,809,459	147,805
1919	3,748,080	454,840
1920	4,272,341	$499,758
1921	8,548,542	546,054
1922	8,989,972	371,161
1923	4,856,357	213,407
1924	3,113,819	207,833

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[1] Statistics of imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Ichthyol and ichthyol substitutes imported for consumption in the United States, 1915–1924

Year	Pounds	Value	Year	Pounds	Value
1915	24, 921	$28, 560	1920	98, 135	$79, 133
1916	116, 738	93, 762	1921	76, 020	107, 752
1917	58, 397	36, 232	1922	74, 330	89, 150
1918	65, 752	39, 452	1923 [a]	20	15
1919	30, 976	38, 975	1924 [a]	9, 300	17, 058

[a] As recorded by Bureau of Foreign and Domestic Commerce. Change in classification under new tariff may account to some extent for great decrease.

Asphalt exported from the United States, 1915–1924

Year	Unmanufactured		Manufactures of	Total
	Short tons	Value		
1915	42, 787	$735, 952	$438, 685	$1, 174, 637
1916	40, 816	759, 769	494, 895	1, 254, 664
1917	30, 107	587, 256	585, 472	1, 172, 728
1918	22, 108	577, 654	577, 936	1, 155, 590
1919	40, 208	1, 103, 930	606, 918	1, 710, 848
1920	51, 706	1, 356, 116	842, 074	2, 198, 190
1921	45, 367	1, 178, 038	621, 224	1, 799, 262
1922	57, 362	1, 344, 440	[a] 1, 261, 125	[a] 2, 605, 565
1923	72, 628	1, 500, 869	[a] 2, 075, 628	[a] 3, 576, 497
1924	52, 568	1, 245, 670	[a] 2, 212, 260	[a] 3, 457, 930

[a] Inclusive of value of squares (10 by 10 feet) of roofing asphalt as follows: 1922, 588,636 squares, $870, 200; 1923, 783,028 squares, $1,124,491; 1924, 697,293 squares, $998,469. Corresponding exports not separately shown prior to 1922.

Asphalt exported from the United States in 1924, by countries

Country	Unmanufactured		Manufactures of, except roofing	
	Short tons	Value	Short tons	Value
North America:				
Canada	7, 121	$131, 672	5, 537	$119, 114
Central America—				
Costa Rica	------	------	3	711
Guatemala	250	8, 680	1	145
Honduras	------	------	10	690
Panama	168	3, 508	374	30, 203
Salvador	------	------	(a)	56
Mexico	43	1, 292	213	11, 053
Newfoundland and Labrador	------	------	3	487
West Indies—				
British—				
Bermuda	3	93	(a)	3
Jamaica	------	------	382	14, 797
Trinidad and Tobago	------	------	(a)	81
Other	59	1, 695	73	667
Cuba	931	24, 173	722	34, 083
Dominican Republic	724	20, 175	232	7, 016
Dutch	1	23	1	113
French	------	------	(a)	20
Haiti	------	------	2	277
Virgin Islands	------	------	(a)	27
South America:				
Argentina	231	4, 620	484	20, 086
Brazil	63	2, 322	348	16, 452
Chile	496	12, 315	191	8, 686
Colombia	36	1, 171	9	828
Ecuador	290	6, 679	45	1, 430
Guiana—				
British	------	------	14	3, 212
Dutch	56	2	------	------

[a] Less than 1 ton.

Asphalt exported from the United States in 1924, by countries—Continued

Country	Unmanufactured		Manufactures of, except roofing	
	Short tons	Value	Short tons	Value
South America—Continued.				
Peru	13	$334	910	$23,970
Uruguay	43	1,415	943	37,371
Venezuela	18	536	55	6,769
Europe:				
Azores and Madeira Islands	----------	----------	(a)	56
Belgium	598	15,467	532	18,631
Denmark	7	133	316	10,518
Finland	56	1,425	68	1,690
France	1,729	62,987	161	8,542
Germany	3,474	96,291	790	21,743
Gibraltar	----------	----------	6	284
Greece	----------	----------	121	3,608
Iceland and Faroe Islands	----------	----------	2	50
Italy	452	15,729	59	1,595
Latvia	----------	----------	21	3,061
Netherlands	507	17,035	22	1,310
Norway	24	579	70	3,567
Spain	71	1,627	243	11,079
Sweden	576	10,731	220	6,474
United Kingdom—				
England	19,200	444,995	7,089	292,669
Ireland	263	9,068	1	16
Scotland	5,235	105,581	406	9,076
Asia:				
Ceylon	----------	----------	274	7,126
China	914	19,234	330	9,842
Chosen	----------	----------	107	2,058
East Indies—				
British—				
India	1,345	32,600	2,504	88,467
Straits Settlements	20	576	623	17,863
Far Eastern Republic	----------	----------	(a)	12
Indo-China (French)	47	1,275	----------	----------
Hongkong	57	1,645	64	2,487
Japan	1,616	41,536	1,882	46,684
Java and Madura	136	3,835	316	8,059
Kwangtung, leased territory	----------	----------	137	3,427
Palestine and Syria	----------	----------	4	212
Philippine Islands	96	2,101	420	12,138
Siam	9	270	----------	----------
Africa:				
Belgian Congo	----------	----------	1	336
British—				
East	----------	----------	235	8,881
South	528	31,637	3,951	135,424
West	----------	----------	(a)	45
Canary Islands	----------	----------	(a)	20
Egypt	133	4,148	448	19,273
French—				
Madagascar	----------	----------	1	102
Other	----------	----------	(a)	12
Morocco	----------	----------	9	256
Portuguese East	2	54	128	3,722
Oceania: British—				
Australia	2,484	49,562	2,424	69,051
New Zealand	2,325	52,769	1,747	45,465
Other	118	2,075	11	513
	52,568	1,245,670	36,295	1,213,791

(a) Less than 1 ton.

WORLD'S PRODUCTION [2]

Production of natural asphalt and related bitumens in the principal producing countries, 1920–1924, in metric tons [a]

Country [b]	1920	1921	1922	1923	1924
Argentina [c]	538	(d)	(d)	(d)	(d)
Barbados [e]	92	111	133	152	(d)
Cuba [f]	3, 043	342	109	392	400
France	25, 024	39, 595	48, 477	35, 650	44, 865
Germany	31, 904	29, 352	54, 619	46, 244	(d)
Greece	1, 730	486	(d)	1, 300	(d)
Italy	107, 626	94, 120	68, 647	151, 908	159, 063
Japan	431	365	(d)	--------	(d)
Peru	17, 162	11, 834	8, 829	(d)	(d)
Philippine Islands	2, 000	(d)	(d)	(d)	(d)
Poland [g]	368	260	414	710	732
Rumania	1, 056	14, 122	13, 016	21, 967	(d)
Spain	4, 222	3, 533	5, 933	3, 936	5, 476
Switzerland	[f] 14, 047	17, 394	22, 045	19, 904	(d)
Trinidad	143, 501	121, 651	185, 587	224, 900	227, 460
United States	180, 073	268, 899	297, 366	363, 086	510, 168
Venezuela	23, 452	48, 489	38, 476	33, 321	69, 892

[a] Minerals included are native asphalt, asphalt rock, asphaltite, manjak, ozokerite, and bituminous rock used for other purposes than the extraction of oil. Oil shales, including ichthyolic shale, are not included.

[b] In addition to those listed above, the following countries are reported to produce asphalt and related bitumens, but figures of output are not available: Albania, Canada (Alberta), Madagascar, Mesopotamia, Russia, and Syria.

[c] Railroad shipments.

[d] Data not available.

[e] Exports of manjak.

[f] Exports.

[g] Ozokerite.

PRODUCERS

Native asphalt and related bitumens were produced commercially in this country in 1924 by the following operators:

Absopure Gilsonite Co., 615 Cooper Building, Denver, Colo.
Alabama Rock Asphalt Co., Florence, Ala.
American Asphalt Association, 919 Wainwright Building, St. Louis, Mo.
City Street Improvement Co., 400 California Street, San Francisco, Calif.
Continental Rock Asphalt Co., Dwight Building, Kansas City, Mo.
Crown Rock Asphalt Co., 911 Neave Building, Cincinnati, Ohio.
Gilson Asphaltum Co., 1900 Land Title Building, Philadelphia, Pa.
Glafcke, Ludlow B., Soldier Summit, Utah.
Kentucky Rock Asphalt Co., Marion E. Taylor Building, Louisville, Ky.
Natural Rock Asphalt Corporation, Owensboro, Ky.
Ohio Valley Rock Asphalt Co., Schmidt Building, Cincinnati, Ohio.
Raven Mining Co. of Utah, 140 South Dearborn Street, Chicago, Ill.
Sattler & Stevens, Carpinteria, Calif.
Texas Rock Asphalt Co., San Antonio, Tex.
Utah Gilsonite Co., Wainwright Building, St. Louis, Mo.
Uvalde Rock Asphalt Co., San Antonio, Tex.
Vernon Asphalt Co., Nevada, Mo.
White, R. L., City National Bank Building, San Antonio, Tex.

The following operators reported that they produced asphaltic material from crude petroleum in the United States in 1924:

Atlantic Refining Co., 260 South Broad Street, Philadelphia, Pa.
Beacon Oil Co., 111 Devonshire Street, Boston, Mass.
Byerlyte Co., 2484 West Fourth Street, Cleveland, Ohio.
Craig Oil Co., Toledo, Ohio.
Crown Bitumens Corporation, Montgomery Street, San Francisco, Calif.
Freeport Asphalt Co., Freeport, Tex.
Gulf Refining Co., Frick Building Annex, Pittsburgh, Pa.
Harbor Refining Co., 2475 East Ninth Street, Los Angeles, Calif.

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[2] Compiled by L. M. Jones, of the Bureau of Mines.

Indian Refining Co., Lawrenceville, Ill.
Magnolia Petroleum Co., Box 1667, Dallas, Tex.
Mexican Petroleum Corporation of Louisiana (Inc.), 120 Broadway, New York, N. Y.
Midwest Refining Co., Denver, Colo.
New Orleans Refining Co., United Fruit Building, New Orleans, La.
Paraffine Companies (Inc.), 475 Brennan Street, San Francisco, Calif.
Pioneer Asphalt Co., Lawrenceville, Ill.
Pioneer Paper Co., 120 Arcade Station, Los Angeles, Calif.
Root Refineries (Inc.), Commercial National Bank Building, Shreveport, La.
Roxana Petroleum Corporation, Arcade Building, St. Louis, Mo.
Seaside Oil Co., Summerland, Calif.
Sinclair Refining Co. of Louisiana, 45 Nassau Street, New York, N. Y.
Standard Oil Co. of California, 225 Bush Street, San Francisco, Calif.
Standard Oil Co. of Indiana, 910 South Michigan Avenue, Chicago, Ill. (plants in Illinois, Indiana, and Missouri).
Standard Oil Co. of Louisiana, Baton Rouge, La.
Standard Oil Co. of New Jersey, 26 Broadway, New York, N. Y.
Standard Oil Co. of New York, 26 Broadway, New York, N. Y.
Standard Oil Co. of Ohio, East Ohio Gas Building, Cleveland, Ohio.
Sun Co., Finance Building, Philadelphia, Pa.
Texas Co., Houston, Tex.
Union Oil Co. of California, Union Oil Building, Los Angeles, Calif.
Warner Quinlan Asphalt Co., 79 Wall Street, New York, N. Y.

The Asphalt Association.—The members of the asphalt industry established in 1919 the Asphalt Association, which, in addition to other activities, is engaged in collecting and disseminating information useful to both producers and users of asphalt. Any one desiring such information may address the association, at 441 Lexington Avenue, New York, N. Y.; or branch offices at the following addresses:

729 Hearst Building, Hearst Square, Chicago, Ill.
Whitney Central Building, New Orleans, La.
314 Dwight Building, Kansas City, Mo.
25 North Pearl Street, Albany, N. Y.
302 Latta Arcade Building, Charlotte, N. C.

The officers are: President, J. R. Draney, of the United States Asphalt Refining Co.; vice president, C. C. Lakin, of the Standard Oil Co. of Indiana; treasurer, Herbert Spencer, of the Standard Oil Co. of New Jersey; secretary and general manager, J. E. Pennybacker.

MICA

By Blanche H. Stoddard

INTRODUCTION

Mica is the name applied to a group of minerals having related chemical structure and similar physical properties. The most characteristic property is an extraordinary capacity to cleave easily in very thin flakes and this together with transparency, toughness, elasticity, high dielectric strength, and other qualities possessed by some varieties renders them commercially valuable. The name was probably derived from the Latin "micare" which means to shine or glitter. The mineral is sometimes called "isinglass," which term, however, is also applied to a gelatinous material obtained from certain fish. Of the many varieties of mica, only two yield the "sheet mica" of commerce. These are muscovite, also known as white mica, and phlogopite, or magnesium mica, also known as amber mica. These are the chief varieties of commerce, but small quantities of biotite, known as black mica, have been used. Other varieties have been used in a small way for other purposes.

Muscovite is the only variety that is now mined on a large scale in the United States; no phlogopite deposits of commercial value have been worked for many years. Deposits of white mica (muscovite) of commercial importance occur only in pegmatite, an igneous rock similar to granite in composition but much coarser grained. The chief minerals of pegmatite are quartz, feldspar, and mica, but the rock also contains smaller quantities of other minerals, such as tourmaline, garnet, and beryl. The mica in the pegmatite dikes is in the form of more or less imperfect crystals called "blocks" or "books," which may be rudely hexagonal, and which range in width from a few inches to several feet, and in thickness from a fraction of an inch to several inches. The terms "book mica" or "block mica" applied to domestic mica are synonymous with "mine-run" or "run-of-mine" mica. When these blocks of mine-run mica are split into thin sheets, about one-sixteenth of an inch in thickness, and the unusable waste removed, the mica is called "sheet" and the waste is called "scrap" mica. Only a small proportion of the blocks, averaging about 10 per cent, is convertible into marketable sheets.

Mica also occurs as small flakes or scales in granite, gneiss, schist, sandstone, and shale, but on account of the small size of such flakes and the impracticability of separating them from the abundant quartz and other hard minerals present, their value as a source of scrap mica is doubtful.

Muscovite is generally light colored, ranging from colorless in thin sheets, to amber yellow, green, brownish-red or "rum" and ruby red in sheets over one-sixteenth of an inch in thickness.

Some of the properties which render muscovite and phlogopite mica commercially valuable are perfect cleavage, toughness, elasticity, transparency, flexibility, low conductivity of heat and electricity, and high dielectric strength. This combination of properties is not found in any other natural or artificial product, and no satisfactory substitute has been found for sheet mica used in certain forms of high-voltage electric insulation. The most prominent characteristic of all the micas is the quality of being easily cleavable into thin, flexible, and generally transparent sheets, and in this characteristic they find their economic usefulness.

Mica possesses other properties which are utilized by the industries. The brilliancy of its small scales makes the mineral of value in the decorative arts. It has also been extensively used as a filler for various goods such as rubber, in the manufacture of patent roofing and as a lubricant.

IMPERFECTIONS OF MICA

The quality of mica is the most important factor in determining the use to which it may be put. Some of the defects that render mica unsuitable for certain purposes are cracks, rulings, markings, inclusions or specks and stains, and color. Other terms for defects in mica used by miners and dealers are "ribbon," "A," "hairline," "fishbone" or "herringbone," "feather," "horsetail," "tanglesheet," "spearhead," "reeved," "cross-grained," and "wedge mica." For a description of some of these physical peculiarities and a discussion of flaws and defects, the reader is referred to Bulletin 740 on the mica deposits of the United States, by Douglas B. Sterrett, published by the United States Geological Survey.

It is seldom that large quantities of mica are produced which do not contain one or more of the many flaws common to the mineral. It is not essential, however, that mica for some purposes be entirely free from all defects. Much electrical mica is spotted or slightly stained, although not enough to prevent its use in some forms of electrical insulation, but spotted mica which contains too many specks or inclusions of iron oxide is unsuited for high-voltage insulation. Some users, however, consider that the small spots or particles of magnetite (black oxide of iron) greatly lessen the value of the mica, for the reason that if used for electrical insulation they form paths for the puncture of the plate. Stove mica is practically clear and has only a few spots or stains.

PRODUCTION

Most of the domestic mica when first sold is roughly trimmed by the fingers, hence the term thumb-trimmed, or it is poorly knife-trimmed. Mica in this form is referred to as "uncut" sheet mica; that is, mica not cut according to specification into special sizes or shapes. The statistics of sheet mica in this report represent mica in this uncut form, or approximately this form.

The following table shows the quantity and value of uncut sheet and scrap mica sold by producers in the United States from 1920 to 1924, inclusive.

Mica sold by producers in the United States, 1920–1924

Year	Sheet mica		Scrap mica		Total	
	Pounds	Value	Short tons	Value	Short tons	Value
1920	1,683,480	$546,972	5,723	$167,017	6,565	$713,989
1921	741,845	118,513	2,577	56,849	2,948	175,362
1922	1,077,968	194,301	[a] 6,641	114,045	[a] 7,180	308,346
1923	2,063,179	311,180	[a] 8,054	129,695	[a] 9,086	440,875
1924	1,460,897	212,035	4,709	87,242	5,439	299,277

[a] Includes mica derived from mica schist.

The figures for sheet mica in 1924 showed a decrease of 29 per cent in quantity and of 32 per cent in value, as compared with 1923. The average value per pound of all sheet mica sold in the United States in 1924 was about 15 cents, the same as in 1923, and the average value per ton of scrap mica increased from $16 in 1923 to $19 in 1924.

Mica occurs in more than 20 States but was produced and sold in 1924 in only 10 of them—North Carolina, New Hampshire, South Dakota, Virginia, New Mexico, Georgia, Colorado, South Carolina, Connecticut, and Alabama, named in order of total quantity sold from greatest to least. The important producing States are New Hampshire and North Carolina.

Mica sold by producers in chief producing States, 1920–1924

Year	Sheet mica			Scrap mica		Total	
	Pounds	Short tons	Value	Short tons	Value	Short tons	Value
New Hampshire:							
1920	284,862	142	$83,811	435	$12,877	577	$96,688
1921	491,743	246	63,249	537	10,613	783	73,862
1922	475,647	238	63,240	238	5,838	476	69,078
1923	835,751	418	107,674	1,078	25,871	1,496	133,545
1924	744,133	372	88,737	492	9,498	864	98,235
North Carolina:							
1920	1,084,946	542	405,654	2,823	91,653	3,365	497,307
1921	230,532	115	51,851	1,353	30,496	1,468	82,347
1922	544,495	272	119,767	[a] 4,205	65,923	[a] 4,477	185,690
1923	1,130,283	565	188,317	[a] 5,005	65,764	[a] 5,570	254,081
1924	597,385	299	108,656	3,212	59,620	3,511	168,276

[a] Includes mica derived from mica schist.

The most notable decreases in 1924 as compared with 1923 were shown by New Hampshire and North Carolina. In New Hampshire sales of uncut sheet mica dropped 11 per cent in quantity and 18 per cent in value, and in North Carolina 47 per cent in quantity and 42 per cent in value. As far as the domestic industry was concerned, the market was reported dull for most of 1924.

Of the other States Alabama reported production in 1924, compared with none in 1923; Colorado and Connecticut showed decreases in sales of scrap mica; Georgia reported sales of more than five times the quantity of sheet mica sold in 1923; New Mexico reported decreased sales of scrap mica; in South Carolina the sales of scrap mica were about the same as in 1923, and there were no sales of sheet mica in 1924, as compared with small sales in 1923; South Dakota showed an increase in quantity of scrap mica sold; and Virginia reported decreases in sales of both sheet and scrap mica.

CLASSIFICATION OF MICA

Mica is valuable in sheet form and as scrap suitable for grinding into a powder. For commercial sheet mica the individual pieces must be large enough to contain a rectangular area measuring at least 1½ by 2 inches, which must split easily and evenly and be nearly free from "cracks," "rulings," "markings," and all fracture lines and reasonably free from inclusions or specks of foreign mineral matter. The size stated is the smallest rectangular size that is salable in the form of uncut sheet; the irregularly bounded rough-trimmed mica sheet must be nearly twice as large to yield this size—in other words, a sheet that would yield a suitable rectangle 1½ by 2 inches and would be classed as "1½ by 2 inches" would have to measure nearly 3 by 4 inches.

Splittings are the thin films or flakes of mica that are split from the smaller sheet or waste material. They are about one-thousandth of an inch thick and are irregular in shape.

Material suitable as scrap mica for grinding must be free from all foreign matter, especially gritty material such as quartz and feldspar.

The system of classification of mica, by sizes, is different in the United States, Canada, and India. The United States classification is as follows (figures represent inches): Punch, circle, 1½ by 2, 2 by 2, 2 by 3, 3 by 4, 3 by 5, 4 by 6, 6 by 6, 6 by 8, 8 by 10, and larger. For punch mica the uncut sheet must be of sufficient size to yield a circle 1½ inches in diameter if stained and 1¼ inches if clear; circle mica should yield a disk nearly 2 inches in diameter.

Canadian or "amber" mica is also classified on the basis of the size of the rectangle obtainable, but the sizes differ from those used for the United States mica. The sizes used for Canadian mica, in inches, are 1 by 1, 1 by 2, 1 by 3, 2 by 3, 2 by 4, 3 by 5, 4 by 6, and 5 by 8.

The Indian classification is not based on the size of the rectangle obtainable but on the area of usable mica in the sheet. The following table shows the Indian system of grading, with the approximate corresponding sizes used in the United States classification:

Grading of Indian mica

Grade	Area of usable mica (in square inches), based on rectangular sizes	Sizes of rectangles that can be cut (in inches)				Approximate corresponding sizes in United States classification (in inches)
		Width		Length		
		Minimum	Maximum	Minimum	Maximum	
6	Less than 3					Punch.
5	3 to 5⅞	1	2	2	2½	2 by 2.
4	6 to 9⅞	1½	2½	2½	3	{2 by 3. {3 by 3.
3	10 to 14⅞	1½	3	3	4½	3 by 4.
2	15 to 23⅞	1½	3½	4½	6	3 by 5.
1	24 to 35⅞	3	5	5	7	4 by 6.
A-1	36 to 47⅞	4	6	7	9	5 by 8.
Special	48 to 59⅞					6 by 8.
Extra special	60 to 71⅞					8 by 8.
Extra extra special	72 and more					8 by 10.

In the following table 67 per cent of the total quantity of uncut sheet mica sold in 1924 has been classified to show the qualities of mica and the average value by sizes. It was not possible to classify a larger percentage, for the reason that some of the reports received did not contain this information. Several of the larger companies sent in returns in great detail, but others have not done so, owing in part to the fact that some mica is not sold by the miner in sheet form classified by sizes, and also to the fact that some of the companies either do not keep an accurate account of the mica they handle or do not wish to furnish the figures.

Clear and stained uncut rough-trimmed sheet mica sold by producers in the United States in 1924, by sizes

[Shows 67 per cent of the total for the United States]

Size	Clear			Stained			Total	
	Pounds	Value		Pounds	Value		Pounds	Percentage
		Total	Average		Total	Average		
Punch or washer	322,255	$37,067	$0.12	466,915	$23,150	$0.05	789,170	80.4
Circle				59,369	4,238	.07	59,369	6.1
1½ by 2 inches	41,482	7,372	.18	141	17	.12	41,623	4.2
2 by 2 inches	26,531	10,279	.39	6,912	1,005	.15	33,443	3.4
2 by 3 inches	21,272	16,104	.76	5,565	1,752	.31	26,837	2.7
3 by 3 inches	8,629	11,408	1.32	2,607	1,880	.72	11,236	1.2
3 by 4 inches	5,233	9,061	1.73	1,853	2,205	1.19	7,086	.7
3 by 5 inches	6,070	13,249	2.18	1,944	3,009	1.55	8,014	.8
4 by 6 inches	2,419	7,016	2.90	1,293	2,496	1.93	3,712	.4
6 by 8 inches	716	3,728	5.21	332	875	2.64	1,048	.1
	434,607	115,284	.27	546,931	40,627	.07	981,538	100.0

Value of mica sold by producers in the United States, 1920–1924

Year	Total	Average	
		Sheet and scrap (per short ton)	Sheet (per pound)
1920	$713,989	$109	$0.32
1921	175,362	59	.16
1922	308,346	43	.18
1923	440,875	49	.15
1924	299,277	55	.15

Scrap mica, or mica that can not be utilized as sheet or splittings, is ground and sold in powdered form. The following table gives the quantity and value of ground mica sold or used by the producers in the United States. The figures are based on all the information procurable from the mica grinders and are partly estimated.

Ground mica sold or used by the producers in the United States, 1923–1924, in pounds

Year	Dry ground		Wet ground		Total	
	Pounds	Value	Pounds	Value	Pounds	Value
1923	5,660,000	$123,450	4,203,000	$250,170	9,863,000	$373,620
1924	5,184,000	101,700	5,735,000	331,410	10,919,000	433,110

The approximate average value for dry ground mica for 1923 and 1924, as indicated by the table, was $40 a short ton, and for wet ground mica $120 a ton.

The consumption of mica splittings in the United States in 1924, as reported by consumers, was as follows: Indian splittings 1,410 short tons, valued at $1,399,791, and Canadian splittings, 295 short tons, valued at $525,180. No domestic or South American splittings were reported, although it is possible that some were used by consumers who have not responded fully to the inquiries made of them.

USES

The most important and extensive use of mica is in the electrical industry, where a noninflammable, resistant insulating material is necessary. Its cleavage, transparency, toughness, softness, flexibility, and elasticity, combined with its resistance to puncture, its infusibility, and imperviousness to moisture, render it an ideal insulator. Mica also finds application in the stove industry for glazing in the fronts of stoves, in furnace sightholes, for screens in front of highly heated material, for optical lanterns as a retarder of heat waves, and for making lamp chimneys, lamp shades, and lantern slides. Mica in fine flake or powdered form is used in the decorative trade, in the manufacture of patent roofing material, in fancy and fireproof paints, ornamental tile, concrete facing, as a lubricant both dry, as for auto tires, and mixed with oil and greases, as an absorbent for nitroglycerin, for annealing steel, and in other ways.

In the electrical industry mica is used largely for making condensers for magnetos for the engines of airplanes, automobiles, and trucks, for radio apparatus, for spark-plug cores, as an insulator between the copper segments of direct-current dynamos and motors, for several kinds of transformers, for washers and rings around many bolts and screens requiring insulation, and for many other electrical purposes. Large disks and washers are used in arc lights and smaller ones in the sockets of incandescent lamps.

High-potential condenser mica must be clear or only slightly stained, must split easily and smoothly into films as thin as one-thousandth of an inch, and must be free from cracks, holes, foreign substances, stains, spots, and air bubbles, and the sheets must be plane and smooth, free from waves, wrinkles, rulings, or knots.

Mica used between the copper segments of commutators must possess high dielectric strength; that is, it must be able to withstand charges of high-voltage electrical current, and be soft enough to wear down evenly with the copper segments. High-grade Indian white mica is considered by some to be preferable for this use, as it has the requisite softness, and its purity and uniformity are additional factors desired. Phlogopite or "amber" mica is also extensively used for this purpose. It is even softer than the Indian, but it is not preferred by some manufacturers because of the greater difficulty in detecting impurities along the cleavage planes, and also because of its lower resistence to heat. For all other insulation, however, the domestic muscovite is satisfactory.

Stove mica is essentially clear, hard, and rigid, and much of the North Carolina mica, especially the greenish, is well adapted for this use. The demand for mica for glazing is comparatively small, and only the best quality and the larger sheets are thus used.

The resonant quality possessed by mica makes it of special value for use in sound-producing and sound-detecting devices such as phonographs, submarine detectors, radiophones and "loud speakers."

Phonograph and other diaphragm mica must be of a very high grade; it must be clear and transparent, free from all cracks, inclusions, stains, air bubbles, or rulings, and must also split easily into perfectly flat sheets, the latter feature being essential.

Mica for lamp chimneys and canopies must be clear and must split easily and be very flexible. Very little domestic mica can be used for this purpose. Indian and Brazilian mica are used instead.

Mica splittings for built-up mica board, which is used in electric insulation, consist of thin flakes or films split from the smaller sheets of mica. Splittings are about one-thousandth of an inch in thickness, are irregular in shape, and contain a very small number of flaws. The built-up product is prepared by first coating a surface with shellac or other binder and laying the flakes thereon irregularly in a single layer. A second coat of binder is then laid over them in such a manner as to cover the spaces between the flakes of the first layer. This process is continued until any required thickness is reached, when the whole is subjected to pressure and baking. In this way large composite sheets are made of uniform thickness, which are free from foreign substances and such imperfections as tend to lessen the value of mica for some insulating purposes. The finished product may be bent, cut, sawed, or drilled. Mica board is used chiefly for plates between the copper segments of commutators, and in dynamos, motors, and transformers.

MICA MINING

Mica mining in the United States is not carried on regularly or systematically by every producer. Many of the mines are worked by small operators who mine only intermittently and use very primitive methods. Operations are frequently of the type known as "gophering" or "groundhogging," which consists of following the blocks of mica as long as the removal of one discloses the presence of another—in other words, obtaining all the mica available without reference to any system of development. This method is popular in some parts of the South and is considered efficient where the run of mica in a deposit is not constant. In this type of workings the waste rock is left to accumulate because of the difficulty of removing it through the small tunnels and openings, and this method soon becomes a hindrance to future development. Improved methods of mining by systematic shafts, tunnels, drifts, stopes, and crosscuts have in some places supplanted the gophering method, and some mines have been equipped with hoists, power drills, pumps, and electric lights, but many mines have not been supplied with such modern equipment.

In some large masses of pegmatite regular quarry methods may be used. This system is common in the New England mica mines where mica is mined in open pits and derricks and inclined tracks are used to remove ore and waste.

Mica deposits are seldom prospected by boring or drilling. The usual method is to prospect by pits, crosscuts, shafts, and tunnels. It is best to try to determine the extent of the deposit on the surface by a series of open cuts across the trend of the mica-bearing dike. The dike should also be tested for depth by one or more shafts. If a quantity of fairly large sheets of mica is not obtained it may not be profitable to continue operations, but if mica is obtained that will cut into perfect sheets several inches square and as clear as window glass, the deposit may prove of value.

PREPARATION

Mica as mined consists of rough crystals or blocks that range from a few inches to several feet across. These rough crystals are cobbed and cleaned of adhering quartz, feldspar, or dirt by rapping them with hammers, or they are cleaned with stout knives. The cleaned crystals are thrown into boxes, which are sent to the culling sheds. The crystals, which may be several inches thick, are first broken into plates about one-fourth of an inch thick. The edges of these plates are sometimes hammered, in order to loosen the laminae and soften the sides for the insertion of the splitting knife, which is a double-edged implement about 3 inches long with a V-point. The sheets of mica are split into thicknesses of one-sixteenth of an inch or less. The rough edges are cut from these plates by knives held at an angle to the cleavage, and the mica is graded for size and quality. Large shears and punches operated either by hand or by power cut the graded mica into patterns desired by the trade. If shears are used, the mica is cut into the desired form around a templet of wood, metal, or composition laid against the mica. Mica-punching machines are supplied with dies to punch disks, washers, and other shapes.

Mica splittings, which are made from the smaller sheets of mica, are "thin split" by a thin-bladed knife into sheets one five-hundredth of an inch or less in thickness. Several devices and processes have been patented to supplant hand labor for this part of the work, but hand splitting is still practiced in many factories.

WORLD'S PRODUCTION[1]

World's production of mica, 1920–1924, in metric tons

Country	1920	1921	1922	1923	1924
North America:					
Canada	1,999	637	3,038	3,197	3,711
United States	5,956	2,674	6,514	8,243	4,934
South America:					
Argentina[a]	65	7	8	102	130
Brazil[a]	68	46	67	56	79
Europe:					
Norway[a]	31	2	1	(b)	(c)
Rumania	135	--------	--------	6	--------
Russia	(c)	(c)	8	(c)	(c)
Spain	5	2	--------	3	--------
Sweden	(c)	(c)	8	5	4
Asia:					
Ceylon[a]	13	5	1	1	--------
Chosen	(c)	11	19	11	23
India (British)	2,385	1,650	1,604	1,720	2,078
Japan	(c)	(c)	15	430	(c)
Africa:					
Madagascar[a]	49	141	92	165	286
Rhodesia	89	77	60	82	136
Tanganyika Territory[a]	27	3	11	33	57
Union of South Africa (Transvaal)	1	1	3	15	735
Oceania:					
Australia—					
Northern Territory	4	1	1	3	3
Queensland	--------	--------	(b)	--------	--------
Western Australia[a]	(b)	--------	2	--------	--------

[a] Exports. [b] Less than one-half ton. [c] Data not available.

The sheet mica from the United States, as reported, is practically all uncut sheet. That from India is uncut sheet[2] and splittings. The Canadian mica is uncut sheet and splittings; the proportion of splittings to sheet is not known but is estimated to be much greater than that for India. For the other countries the mica reported is essentially trimmed sheet.

World's production of sheet mica, 1920–1924, in metric tons

Year	United States	India	Canada	Other countries[a]	Total	Percentage of total in United States
1920	764	2,385	[b] 1,000	487	4,636	16
1921	337	1,650	180	296	2,463	14
1922	489	1,604	179	296	2,568	19
1923	936	1,720	412	912	3,980	24
1924	663	2,078	(c)	1,453	(c)	(c)

[a] Data incomplete, as no figures of production are available for some of the countries.
[b] Estimated by the U. S. Geological Survey on the basis of one-half of the total reported production of mica in Canada
[c] Data not available.

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[1] The figures for world production were compiled by L. M. Jones, of the Bureau of Mines.
[2] Although the Madras square-trimmed mica is termed "cut mica" in import schedules, in reality it is uncut trimmed mica.

IMPORTS AND EXPORTS[3]

The imports of uncut sheet mica in 1924 were 671,793 pounds, valued at $419,154. Imports of mica in 1924 were received from 23 countries.

Mica imported for consumption in the United States, 1921–1924

Kind	1921		1922		1923		1924	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Unmanufactured[a]	328,444	$331,219	385,653	$359,793	1,044,366	$532,375	671,793	$419,154
Cut and split[b]	(c)	758,521	(c)	[d]555,243	(d)	(d)	(d)	(d)
Ground	134,650	2,166	313,745	4,514	1,867,385	28,324	1,342,107	22,034
Cut mica (dimension sheets)	(f)	(f)	[e]42,579	[e]18,372	60,135	49,268	74,534	69,018
Splittings			[e]1,063,306	[e]371,801	4,301,727	1,730,532	3,619,229	1,681,774
Built-up mica boards, cups, tubes, and mica plates			[e]1,807	[e]2,860	30,032	37,382	18,205	41,455
Washers			[e]2,562	[e]675	20,164	6,776	18,517	5,325
Other manufactures			[e]7,842	[e]17,364	7,044	20,191	56,766	88,146
	--------	1,091,906	-----------	1,330,622	7,330,853	2,404,848	5,801,151	2,326,906

[a] Essentially uncut trimmed sheets.
[b] Includes the Madras square-shaped uncut sheets.
[c] Quantities not recorded prior to new tariff, Sept. 22, 1922.
[d] Classification discontinued with new tariff and items shown separately.
[e] Sept. 22–Dec. 31.
[f] Not separately classified prior to new tariff.

The import duty on mica as fixed by the tariff act of September 22, 1922, paragraph 208, is as follows:

> Mica, unmanufactured, valued at not above 15 cents per pound, 4 cents per pound, valued above 15 cents per pound, 25 per centum ad valorem; mica, cut or trimmed, and mica splittings, 30 per centum ad valorem; mica plates, and built-up mica, and all manufactures of mica or of which mica is the component material of chief value, 40 per centum ad valorem; ground mica, 20 per centum ad valorem.

Mica and manufactures of mica were exported to 48 countries in 1924, but about 88 per cent of the total quantity, which was 1,519,636 pounds, went to Canada, England, and France, in the order named. The total value of the mica exported was $169,741, against $182,162 in 1923.

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[3] The figures for imports and exports were compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Mica imported into the United States in 1924, by kinds and by countries

[General imports]

Country	Crude or unmanufactured				Cut mica, dimension sheets (duty 30 per cent)		Mica splittings (duty 30 per cent)		Ground mica (duty 20 per cent)		Built-up mica products, boards, cups, tubes, and mica plates (duty 40 per cent)		Washers (duty 40 per cent)		Other manufactures, not specially provided for (duty 40 per cent)		Total	
	Valued at not above 15 cents per pound (duty 4 cents per pound)		Valued at above 15 cents per pound (duty 25 per cent)															
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Aden			2,801	$524													2,801	$524
Africa:																		
British—																		
East			3,553	1,650													3,553	1,650
South			18,412	8,223											799	$287	19,211	8,510
Portuguese—																		
East			3,615	2,317													3,615	2,317
Other			959	560													959	560
Argentina	10,226	$1,013	43,523	26,410	594	$558	3,653	$4,825							866	492	58,862	33,298
Australia			114	139	50	20									169	349	333	508
Austria			179	69													179	69
Brazil			41,212	42,278											573	860	41,785	43,138
Canada	68,768	1,171	177,005	47,562	2,234	1,874	518,814	384,225	1,342,005	$22,024	29	$96			170	233	2,109,025	457,185
China					219	42											219	42
England	2,364	242	77,564	86,358	16,573	22,534	161,719	33,948	100	8	839	1,766			4,683	10,634	263,842	155,490
France	1,102	20	29,939	18,736			123,052	32,198			69	125			1,705	1,951	155,867	53,030
Germany			1,500	3,858	1,684	4,112	1,598	2,207	2	2	11,287	16,068			43,398	57,319	59,469	83,566
Guatemala			2,961	1,404	11,273	5,991	12,850	1,987							1,010	118	28,094	9,500
India (British)	10,060	1,305	123,505	160,389	22,678	32,428	2,996,625	1,269,002			2,988	4,659	23,987	$6,390	9,130	25,060	3,188,913	1,499,233
Italy			185	228													185	228
Japan			90	20													90	20
Madagascar							198	142									198	142
Mexico							200	130									200	130
Scotland			2,136	7,386	372	520					171	74					2,679	7,980
Switzerland					300	712					731	16,992			1,188	10,175	2,219	27,879
Venezuela	70,540	5,513															70,540	5,513
	163,000	9,264	529,253	408,111	55,977	68,791	3,818,709	1,728,664	1,342,107	22,034	16,114	39,780	23,987	6,390	63,691	107,478	6,012,838	2,390,512

SILICA

By Frank J. Katz[1]

INTRODUCTION

Silica (SiO_2) occurs in deposits of commercial importance in many different forms, such as vein quartz, as a constituent of pegmatites, as sand, sandstone, quartzite, or flint, as tripoli, and as diatomaceous (infusorial) earth. In some forms, such as rose, smoky, and amethystine quartz, it has value as gems. This chapter deals with silica of all kinds except gem quartz, silica sand or sandstone used for making glass, and silica used in the form of sand, gravel, and crushed material for building, for concrete and mortar, for foundry and furnace work, and for cutting and grinding stone. Such material as is not here included is either gem material or sand, is commercially so designated, and is therefore considered in other chapters of Mineral Resources. Tripoli and diatomaceous earth are to a large extent consumed as abrasives and are considered in the chapter on abrasive materials.

USES

Silica as considered in this chapter is used for many purposes, principally in the manufacture of pottery, paints, and scouring soaps, as a wood filler, as a polisher, and in metallurgical and chemical processes. In the pottery industry, where it is generally called flint, silica is used in the body of the ware to diminish shrinkage and is also used in glazes. Silica for use in pottery should contain less than 0.5 per cent of iron-bearing minerals. Manufacturers of paint use considerable quantities of very finely ground silica, which forms as much as one-third of the total pigment in some paints. For this purpose finely ground crystalline material is superior to fine sand in its natural state because of the angularity of the grains, which makes them adhere more firmly to the article painted and after wear affords a good surface for repainting. The same angularity makes artificially comminuted crystalline quartz superior to natural sand for use in wood fillers. For soaps and polishing powders ground material is preferred to natural sand on account of its whiteness and angularity. For all these purposes large quantities of pure quartz sand and sandstone are finely ground and yield a product fully equal to that obtained by grinding massive crystalline quartz.

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[1] Statistics for production were prepared by Estelle R. Phillips, of the Bureau of Mines. Figures for imports were compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Quartz crushed and graded to various sizes is used in making sandpaper and sand belts, as a scouring agent, for "frosting" glass with sand-blast apparatus, and for other purposes. Blocks of massive quartz and quartzite are used in the chemical industry as a filler for acid towers and as a flux in copper smelting. Crushed and ground quartz is also used in filters. Finely ground quartz is used in tooth powders and by dentists as a detergent. Silica of one form or another fused with soda ash makes sodium silicate ("water glass"), of which large quantities are manufactured for a great variety of uses.

Sand and crystalline quartz have been used in making silicon and alloys of silicon with iron, copper, and other metals in the electric furnace. Quartz may be fused in the electric furnace to make chemical apparatus, such as tubes, crucibles, and dishes. The report on silica in Mineral Resources for 1922 may be consulted for an account of the manufacture, properties, and uses of quartz glass thus made. The art of making fused quartz is nearly a hundred years old, but most of the early work was concerned with the opaque varieties made from sand. Only during the present century has progress been made in the development of clear fused quartz.

The material known commercially in the United States as tripoli, which is the siliceous residue of decomposed limestone, also yields an excellent grade of pulverized silica, which is used for the same purpose as silica powder obtained from massive crystalline quartz and from sand and sandstone. Diatomaceous (infusorial) earth is also used to make polishing powder and other products that are employed for uses similar to those for which quartz, sand, and tripoli powders are employed, but diatomaceous earth has somewhat different properties, and most of it finds different application as insulating and filter material.

SHIPMENTS

The total production of the silica materials considered in this report, including tripoli and diatomaceous earth, as given in the table on page 185 showed a decrease of 5 per cent in quantity, following the 46 per cent increase of 1923. Quartz (crude and ground) from pegmatite dikes, from veins, and from quartzite increased, as did tripoli, but ground sand and sandstone as well as diatomaceous earth decreased.

Shipments of crude and crushed quartz were reported by producers in California, Connecticut, Maryland, Massachusetts, Nevada, New Hampshire, New York, North Carolina, Pennsylvania, Utah, Washington, and Wisconsin. Values for the crude ranged between $2.36 and $10 a short ton f. o. b. mines, with an average value of $4.84, and for the crushed quartz between $3.69 and $17.03, with an average of $10.12 f. o. b. plants. Ground quartz amounting to 3,191 short tons, valued at $80,078 was manufactured by producers of the crude in four of these States: California, Maryland, Massachusetts, and Wisconsin. Including other ground quartz which duplicates some of the crude in this report and which was manufactured in California, Connecticut, and New Jersey by purchasers of the crude, the total quantity of ground quartz reported amounted to 11, 265 short tons, valued at $262,639. Values per ton commonly ranged between $17.05 and $36.67 f. o. b. mills, exceptional lots being reported as low as $4.06, and the average value was $23.31. Some grinders obtained the crude quartz from other States, as in California where considerable material from Nevada was ground.

Sand and sandstone were ground in six States: Illinois, New Jersey, North Carolina, Pennsylvania, Virginia, and West Virginia, the production amounting to 230,432 short tons, valued at $1,655,056. Values ranged commonly between $4.23 and $10.50 a ton, with exceptional values reaching as high as $28.63, and with an average value of $7.18. To avoid duplication of figures some high-grade material made by regrinding purchased material previously ground by others is not included here.

Silica sold by producers for pottery, paints, fillers, polishers, abrasives, and other uses in the United States, 1922–1924

Material	1922		1923		1924	
	Short tons	Value	Short tons	Value	Short tons	Value
Quartz (vein quartz, pegmatite, and quartzite)	10, 653	$101, 347	20, 601	$193, 630	23, 761	$203, 177
Sand and sandstone [a]	163, 295	1, 061, 057	249, 467	1, 672, 961	230, 432	1, 655, 056
Tripoli (ground and otherwise prepared)	30, 205	316, 728	27, 082	382, 757	28, 476	389, 409
Diatomaceous earth	44, 761	386, 669	65, 833	699, 406	63, 163	693, 917
	248, 914	1, 865, 801	362, 983	2, 948, 754	345, 832	2, 941, 559

[a] Includes only finely ground material. Figures probably incomplete.

IMPORTS

Data on imports of silica materials are found in the records of the Bureau of Foreign and Domestic Commerce under the classifications "silica, crude," "silica, for use as pigment," and "flint, flints, and flint stones, unground." Imports of crude silica amounting to 12 short tons, valued at $254, are reported for 1924 and 34 tons, valued at $550, for 1923. No imports of silica for use as pigment have been reported. The imports of "flint, flints, and flint stones, unground," are flint pebbles for use in grinding mills and for uses such as are listed in this report.

"Flint, flints, and flint stones, unground," imported for consumption in the United States, 1919–1924

Year	Short tons	Value	Year	Short tons	Value
1919	19, 798	$250, 096	1922	16, 040	$145, 805
1920	26, 636	338, 630	1923	15, 952	130, 974
1921	10, 084	116, 157	1924	17, 473	114, 958

As shown by the following table, France was the source of 67 per cent of this imported material in 1924, Denmark 21 per cent, Belgium 11 per cent, and the balance came from Germany, Ireland, England, Canada, and Argentina, in the order named.

"Flint, flints, and flint stones, unground," imported into the United States, 1923–24, by countries

Country	1923		1924	
	Short tons	Value	Short tons	Value
Argentina			(a)	$20
Belgium	2,012	$22,152	1,929	26,089
Canada	766	3,409	6	84
Czechoslovakia	32	484		
Denmark	3,908	43,886	3,681	33,892
England	34	365	9	157
France	8,955	57,401	11,636	53,080
Germany	226	2,572	184	1,497
Ireland			28	139
Japan	(a)	5		
Norway	19	700		
	15,952	130,974	17,473	114,958

[a] Less than 1 ton.

FUEL BRIQUETS

By W. F. McKenney [1]

PRODUCTION

Along with the mining of soft coal, the manufacture of fuel briquets reacted sharply in 1924 from the high record established in 1923.

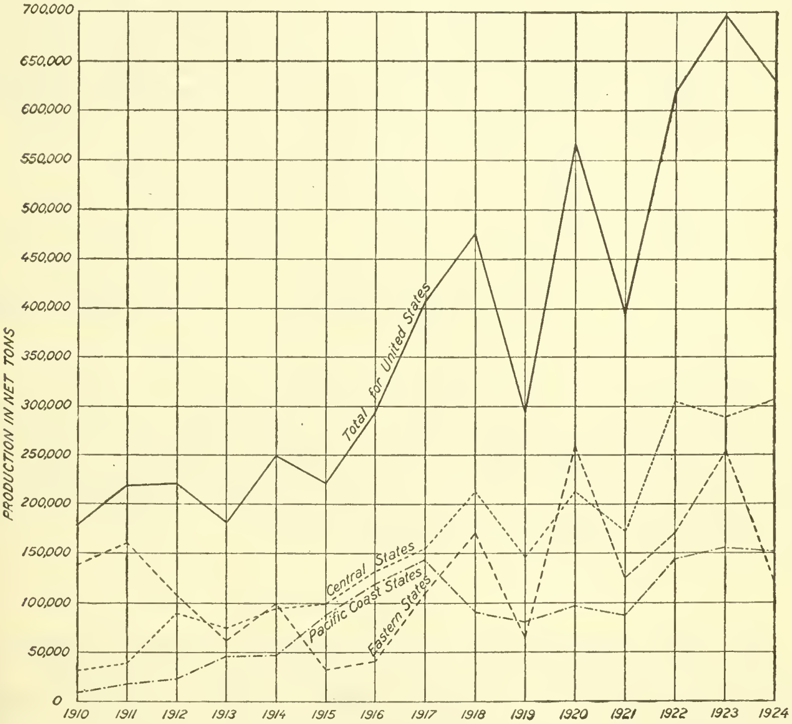

Figure 1.—Fuel briquets produced in the Eastern, Central, and Pacific Coast States and in the United States, 1910–1924

The total output was 580,470 net tons, a decrease of 116,340 tons, or 17 per cent. This decline carried production to a point well below that recorded in 1922 and nearly to the level of 1920. The curve in Figure 1 shows the trend of production during the last 15 years.

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[1] The tables in this report were prepared by Miss J. M. Corse, of the Bureau of Mines, who has compiled the statistics on fuel briquets since 1911.

Fuel briquets produced in the United States, 1923–24 [a]

	1923		1924	
	Net tons	Value	Net tons	Value
Eastern States	252, 166	$1, 678, 038	121, 022	$726, 976
Central States	289, 314	2, 705, 019	308, 370	2, 775, 544
Pacific Coast States	155, 330	1, 515, 641	151, 078	1, 484, 102
	696, 810	5, 898, 698	580, 470	4, 986, 622

[a] List of producers shown on p. 191.

A noteworthy feature of 1924 was a decrease of 52 per cent in the output of plants in the Eastern States, which accounted for nearly the entire loss in total production. As the demand for fuel briquets in that territory is closely related to the supply and price of competing raw coals, this decrease may be traced to the heavy stocks of coal held by consumers and dealers at the beginning of the year, to the uninterrupted production of anthracite, and to the low prices on soft coal throughout the year. Production at plants along the Pacific coast was about 3 per cent less than in 1923, but at the plants of the Central States there was an increase of nearly 7 per cent.

Fuel briquets produced in the United States, 1919–1924

Year	Net tons	Value	Year	Net tons	Value
1919	295, 734	$2, 301, 054	1922	619, 425	$5, 444, 926
1920	567, 192	4, 623, 831	1923	696, 810	5, 898, 698
1921	398, 949	3, 632, 301	1924	580, 470	4, 986, 622

The State of Wisconsin again stood first in point of production, and the output of its two plants more than trebled that of any other State. The other producing States listed in the order of their output were Washington, Pennsylvania, Oregon, Virginia, Missouri, California, and New Jersey. The largest actual decrease in comparison with 1923 was in Pennsylvania, where production in 1924 was less than 48 per cent of that in the preceding year.

VALUE

The value of the briquets manufactured in 1924 was $4,986,622, a decrease of $912,076, or 15 per cent, when compared with 1923. The average value per ton, however, rose from $8.47 to $8.59. Despite this increase the average value per ton was $0.20 less than in 1922. The increase in average value in the face of a decrease of 15 per cent in total value is explained by the fact that the low-priced product of Pennsylvania formed a much smaller part of the total output than in 1923. The following table, which shows the course of the average value per ton in Pennsylvania and in the Central States during the last 14 years, illustrates better the trend in prices of briquets. In both regions the average value declined.

Average value per ton (f. o. b. plant) of briquets produced in Pennsylvania and in the Central States, 1911–1924

Year	Pennsylvania	Central States	Year	Pennsylvania	Central States
1911	$2.37	$4.34	1918	$4.11	$8.17
1912	2.68	4.47	1919	4.17	8.47
1913	2.65	4.92	1920	5.60	9.23
1914	2.48	4.83	1921	6.14	9.28
1915	2.90	4.26	1922	5.93	9.02
1916	3.83	4.73	1923	5.95	9.35
1917	3.15	6.81	1924	5.82	9.00

These figures of value per ton do not represent prices but are merely the number of dollars per ton, on the average, received by the manufacturers f. o. b. their plants. Since the plants very often are hundreds of miles from the points of consumption, consumers pay in addition the cost of transportation. A large part of the total output of briquets, probably about 80 per cent, is sold by the manufacturers to wholesalers or retailers whose margin is included in the price paid by the consumers. (See notes on marketing and distribution in Mineral Resources, 1923, Part II, p. 43.)

The great difference between the average value per ton of the product of plants in the Eastern States and that of plants in the Central West is due in large measure to the situation of the plants. The eastern plants are in or near the coal-producing districts that supply the raw fuel, whereas the plants in the Central West are far from coal districts. Transportation is an important item in the cost of production and is reflected in the average value of the manufactured product at the plants.

SEASONAL FLUCTUATIONS IN THE PRODUCTION OF BRIQUETS

Since briquets are used in the United States almost exclusively for household heating, the demand is highly seasonal, and most plants are forced to curtail production sharply during the summer, if not to close entirely for a period. The variations in each month of 1924 are shown in the following table. In May and June, the months of lowest production, the output was less than one-fifth of that of December. Indeed, 6 of the 12 plants were closed for one or more months during the summer.

Monthly production of fuel briquets in the United States in 1924, in net tons

January	80,938	August	40,743
February	42,609	September	65,745
March	24,953	October	74,873
April	20,183	November	80,936
May	17,795	December	90,067
June	16,017		
July	25,611		580,470

RAW MATERIALS AND BINDERS

The total quantity of raw fuel used in 1924 was 583,365 net tons, of which 39 per cent was anthracite and semianthracite, 51 per cent was semibituminous and bituminous slack, and 10 per cent was oil-gas residue. As the quantity of binders added was less than the weight of the moisture expelled, there was a net loss of 2,895 tons during the process of manufacture. Of the 12 plants that reported production in 1924, 4 used anthracite culm or fines as fuel constituent, 2 semianthracite, 2 a mixture of anthracite culm or fines and bituminous slack, 1 semibituminous slack, 1 bituminous slack, and 2 carbon residue from the manufacture of oil gas.

As in previous years, the binder most commonly used was asphaltic pitch, and its use was reported by 6 of the 12 plants operated in 1924. Another plant used a mixture of asphaltic pitch and coal-tar pitch, and still another a mixture of asphaltic pitch and starch; one used coal-tar pitch alone, one used sulphite liquor, and two used no binder.

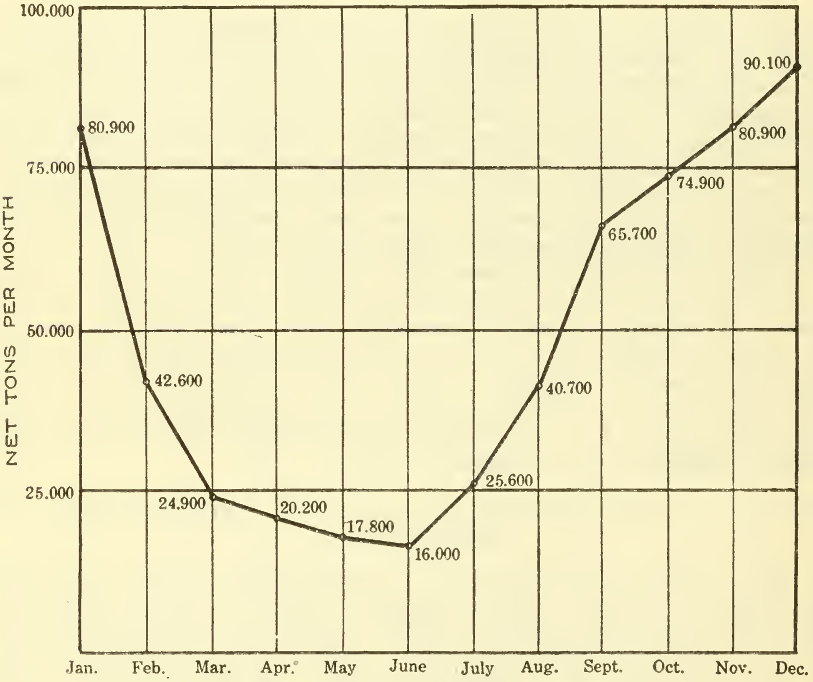

FIGURE 2.—Fluctuations in monthly production of fuel briquets in 1924

Raw fuels used in making briquets in the United States, 1920–1924, in net tons

Fuel	1920	1921	1922	1923	1924
Anthracite culm and fine sizes and semianthracite	356, 877	190, 964	254, 563	331, 102	224, 539
Semibituminous and bituminous slack and coke	[a] 125, 506	121, 925	235, 542	[a] 225, 508	[a] 297, 814
Lignite, subbituminous coal, and oil-gas residue	89, 656	[b] 85, 352	[b] 123, 339	[b] 125, 880	[c] 61, 012
	572, 039	398, 241	613, 444	682, 490	583, 365

[a] Includes no coke. [b] Includes no brown lignite. [c] Includes no brown lignite or subbituminous coal

BRIQUETTING PLANTS IN THE UNITED STATES

Of the plants that were active in 1923 the Burnrite Coal Briquette Co., Newark, N. J., and the Scranton Anthracite Briquette Co., Dickson City, Pa., were idle throughout 1924. An experimental plant was put in operation at Akron, Ohio, by the P. E. Welton Engineering Co. for demonstration purposes only. In all 12 plants were active in 1924.

Briquetting plants operated in the United States in 1924

Group and State	Name and address of operator	Location of plant	Date put in operation	Raw fuel used
Eastern States:				
New Jersey	Anthracite Manufacturing Co., 520 Brunswick Avenue, Trenton, N. J.	Trenton	1918	Anthracite.
Pennsylvania	American Briquet Co., 402 Land Title Building, Philadelphia, Pa.	Lykens	1920	Do.
Do	Anthracite Briquette Co., Sunbury, Pa.	Sunbury	1919	Do.
Do	Lehigh Coal & Navigation Co., 437 Chestnut Street, Philadelphia, Pa.	Lansford	1909	Do.
Virginia	Delparen Anthracite Briquette Co., Parrott, Va.	Parrott	1915	Virginia semianthracite.
Do	Virginia Fuel Corporation, 930 High Street, Portsmouth, Va.	Portsmouth	1923	Anthracite and bituminous slack.
Central States:				
Missouri	Standard Briquet Fuel Co., 319 North Fourth Street, St. Louis, Mo.	Kansas City	1909	Arkansas semianthracite.
Wisconsin	Berwind Fuel Co., 122 South Michigan Avenue, Chicago, Ill.	Superior	1912	Semibituminous slack.
Do	Stott Briquet Co., Merchants National Bank Building, St. Paul, Minn.	do	1909	Anthracite fines and bituminous slack.
Pacific Coast States:				
California	Los Angeles Gas & Electric Corporation, 810 South Flower Street, Los Angeles, Calif.	Los Angeles	1905	Carbon (petroleum residue).
Oregon	Portland Gas & Coke Co., Gasco Building, Portland, Oreg.	Portland	1913	Do.
Washington	Pacific Coast Coal Co., 612 L. C. Smith Building, Seattle, Wash.	Renton	1914	Bituminous slack.

NEW FORMS OF MANUFACTURED FUEL

An event of interest in 1924 was the organization of the Superfuel Corporation of New York to develop the Trent process and apply it to the manufacture of a compressed fuel known as superfuel cylinders.

Briefly, the Trent process consists of crushing and grinding coal to a very fine powder and thoroughly mixing it with an emulsion of fuel oil and water. The mixture is violently agitated and the fuel oil and carbonaceous content of the coal combine to form pellets. In this form the fuel is soft and yielding and is known as amalgam. It may be burned in boilers without further treatment. To prepare the amalgam for domestic utilization it is pressed into cylindrical form by passing through an extruding machine which cuts it into the required lengths. These cylinders are then passed through a Vandergrift retort, which bakes them into a hard fuel and at the same time recovers a part of the oil and volatile matter. An important result of the process is a great reduction in the ash content of the coal constituent; in the process of amalgamation the ash tends to remain with the water, and the coal combines with the oil. This fact places the fuel in a somewhat different class from the average briquet, in the manufacture of which in American practice no attempt is made to lower the percentage of ash in the raw coal.

The Superfuel Corporation is operating an experimental plant at Newark, N. J., which it proposes to put on a commercial basis during the coming year. The corporation has contracts to erect and operate several plants on a royalty basis. One plant—that of the Ohio Trent Coal, Coke & Amalgam Co., Toledo, Ohio—produced and shipped a considerable quantity of amalgam in 1924. This fuel may not be classed as a fuel briquet, and the quantity produced has not been included in the output of briquets.

WORLD'S PRODUCTION OF FUEL BRIQUETS

The following table, prepared by W. I. Whiteside, of the Bureau of Mines, presents the information now available on the world's production of fuel briquets from 1919 to 1924. The figures are taken in the main from official sources but some have been obtained from trade publications and are subject to revision upon receipt of more accurate data. The figures are in metric tons (2,204.6 pounds) which are roughly equivalent to long or gross tons (2,240 pounds).

World's production of fuel briquets, 1919–1924

[In metric tons of 2,204.6 pounds]

Country [a]	1919	1920	1921	1922	1923	1924
Algeria	19, 000	31, 000	33, 000	27, 000	31, 000	79, 000
Belgium	2, 548, 000	2, 846, 000	2, 677, 000	2, 497, 000	1, 929, 000	2, 012, 000
Czechoslovakia	229, 000	284, 000	334, 000	237, 000	296, 000	251, 000
France	2, 839, 000	4, 012, 000	4, 204, 000	4, 885, 000	3, 056, 000	3, 221, 000
Germany:						
Coal	4, 081, 000	4, 894, 000	5, 736, 000	5, 758, 000	1, 942, 000	3, 743, 000
Lignite	19, 611, 000	23, 882, 000	28, 031, 000	29, 422, 000	26, 854, 000	29, 665, 000
Saar	([b])	33, 000	28, 000	([c])	([c])	([c])
Indo-China	([c])	56, 000	([c])	31, 000	46, 000	75, 000
Netherlands	584, 000	634, 000	585, 000	626, 000	474, 000	542, 000
Poland	([b])	([b])	([b])	([d])	309, 000	444, 000
Spain	587, 000	742, 000	733, 000	676, 000	664, 000	627, 000
United Kingdom	2, 094, 000	2, 332, 000	1, 081, 000	1, 354, 000	1, 168, 000	1, 209, 000
United States	268, 000	515, 000	362, 000	562, 000	632, 000	527, 000
Venezuela	([c])	2, 000	2, 000	7, 000	4, 000	([c])

[a] In addition to the countries listed, Canada reports 37,000 tons produced in 1923; other briquet-manufacturing countries, for which figures have not been obtained, are Hungary (production unimportant), Russia, and Switzerland.

[b] Included with Germany.

[c] Data not available.

[d] The production of briquets in Polish Upper Silesia in 1922 was 198,000 tons. This figure is not included in the table as it duplicates the output from January to May, which is already included in the German production.

LIME

By G. F. Loughlin and A. T. Coons

GENERAL CONDITIONS

Sales of lime by producers in the United States in 1924 show practically no change in quantity and a reduction of 1 per cent in value from the figures for 1923. A decrease of 3 per cent in quantity of chemical lime sold during the year offset increases of 2 per cent and 3 per cent, respectively, in the quantities of building and agricultural lime sold. Of the lime sold in 1924, 97 per cent was manufactured in 22 States, each of which produced more than 25,000 tons. Of these producing States 8 showed increase and 14 decrease in quantity of sales. Ohio, the largest producing State, increased 8 per cent, and Pennsylvania, the second State, decreased 9 per cent in quantity sold. The increase in Ohio was chiefly in sales of building lime, and the decrease in Pennsylvania was in sales of chemical lime. Ohio also showed increases in sales of agricultural and of chemical lime. The total number of plants reporting operations was 28 less than in 1923. The number of burners of lime for purely local, including farm, use continued to decrease as is shown by the decreased number of plants in Maryland and Pennsylvania. Labor conditions at the plants apparently changed little during 1924. Wages remained about the same as in 1923; the cost of materials, except coal, was slightly more than in 1923, and prices showed a downward trend. The average value, at the plants, of lime sold, decreased from $9.81 a ton in 1923 to $9.72 in 1924.

PRODUCTION

Lime sold by producers in the United States, 1915–1924

Year	Number of plants in operation	Short tons	Value [a]	
			Total	Average
1915	906	3, 622, 810	$14, 424, 036	$3. 98
1916	778	4, 073, 433	18, 509, 305	4. 54
1917	595	3, 786, 364	23, 807, 877	6. 29
1918	496	3, 206, 016	26, 808, 909	8. 36
1919	539	3, 330, 347	29, 448, 553	8. 84
1920	515	3, 570, 141	37, 543, 840	10. 52
1921	520	2, 532, 153	24, 895, 370	9. 83
1922	530	3, 639, 617	33, 255, 039	9. 14
1923	467	4, 076, 243	39, 993, 652	9. 81
1924	439	4, 072, 000	39, 596, 423	9. 72

[a] The value given represents the value of bulk lime f. o. b. at point of shipment and does not include cost of barrel or package.

Lime sold by producers in the United States, 1923–24, by States

State	1923			1924		
	Number of plants in operation	Short tons	Value	Number of plants in operation	Short tons	Value
Alabama	12	193, 429	$1, 627, 539	10	204, 059	$1, 812, 282
Arizona	3	18, 764	264, 683	3	27, 972	331, 756
Arkansas	3	14, 941	136, 185	3	13, 984	131, 108
California	8	66, 703	869, 979	10	59, 583	658, 138
Colorado	3	(a)	(a)	4	(a)	(a)
Connecticut	6	59, 158	813, 254	6	58, 851	796, 541
Florida	2	(a)	(a)	2	(a)	(a)
Georgia	1	(a)	(a)	1	(a)	(a)
Hawaii	1	(a)	(a)	1	(a)	(a)
Idaho	2	(a)	(a)	1	(a)	(a)
Illinois	11	92, 633	978, 658	10	89, 132	934, 199
Indiana	7	126, 296	1, 151, 083	7	116, 927	991, 003
Iowa	2	(a)	(a)	2	(a)	(a)
Kentucky	1	(a)	(a)	3	8, 091	58, 228
Maine	4	139, 781	1, 946, 486	4	125, 688	1, 809, 929
Maryland	14	63, 858	553, 811	11	56, 178	470, 105
Massachusetts	10	180, 720	2, 550, 575	11	194, 402	2, 693, 028
Michigan	7	59, 629	612, 369	7	73, 096	702, 072
Minnesota	4	29, 805	339, 957	4	25, 764	319, 066
Missouri	16	246, 326	2, 505, 785	18	243, 465	2, 354, 175
Montana	2	(a)	(a)	3	2, 374	25, 316
Nevada	1	(a)	(a)	1	(a)	(a)
New Jersey	2	(a)	(a)	3	204	1, 516
New Mexico	3	1, 859	19, 362	3	2, 389	23, 975
New York	15	100, 862	1, 037, 737	12	98, 592	991, 799
North Carolina	1	(a)	(a)	1	(a)	(a)
Ohio	31	867, 982	8, 740, 688	21	934, 407	9, 511, 270
Oklahoma	2	(a)	(a)	1	(a)	(a)
Oregon	1	(a)	(a)	2	(a)	(a)
Pennsylvania	143	772, 839	6, 372, 732	136	700, 380	5, 634, 806
Porto Rico	24	6, 167	71, 014	19	8, 264	132, 365
Rhode Island	1	(a)	(a)	1	(a)	(a)
South Dakota	2	(a)	(a)	2	(a)	(a)
Tennessee	16	131, 995	1, 028, 158	18	144, 292	1, 111, 781
Texas	9	62, 822	606, 976	5	60, 565	570, 334
Utah	11	12, 228	152, 136	10	12, 853	172, 434
Vermont	10	58, 681	702, 588	10	56, 484	710, 739
Virginia	33	182, 604	1, 490, 306	31	172, 776	1, 409, 447
Washington	6	25, 895	359, 510	6	28, 188	353, 450
West Virginia	11	241, 601	2, 029, 061	10	238, 714	1, 884, 682
Wisconsin	25	227, 549	2, 055, 646	25	235, 030	2, 129, 701
Wyoming	1	(a)	(a)	1	(a)	(a)
Undistributed		91, 116	977, 374		79, 296	871, 178
	467	4, 076, 243	39, 993, 652	439	4, 072, 000	39, 596, 423

[a] Included under "Undistributed."

Lime sold by producers in the United States, 1923–24, by uses

Use	Quantity		Value	
	Percentage of total	Short tons	Total	Average
1923				
Agricultural	5.9	240,551	$1,825,519	$7.59
Building	52.3	2,131,533	22,521,638	10.57
Chemical:				
Glass works	1.9	78,942	676,291	8.57
Metallurgy	9.2	373,020	3,044,383	8.16
Paper mills	7.6	311,309	2,768,909	8.89
Refractory lime (dead-burned dolomite)	8.8	357,642	3,599,116	10.06
Sugar refineries	.3	13,044	164,039	12.58
Tanneries	1.3	53,906	523,994	9.72
Other uses [a]	12.7	516,296	4,869,763	9.43
Total chemical	41.8	1,704,159	15,646,495	9.18
	100.0	4,076,243	39,993,652	9.81
Hydrated lime (included in above totals)		1,225,928	12,229,598	9.98
1924				
Agricultural	6.1	248,336	1,864,514	7.51
Building	53.3	2,169,700	23,011,935	10.61
Chemical:				
Glass works	1.8	72,822	622,456	8.55
Metallurgy	8.3	336,813	2,727,518	8.10
Paper mills	7.3	300,101	2,528,242	8.42
Refractory lime (dead-burned dolomite)	8.1	328,659	3,209,257	9.76
Sugar refineries	.4	17,061	246,079	14.42
Tanneries	1.3	53,349	515,133	9.66
Other uses [a]	13.4	545,159	4,871,289	8.94
Total chemical	40.6	1,653,964	14,719,974	8.90
	100.0	4,072,000	39,596,423	9.72
Hydrated lime (included in above totals)		1,316,664	13,199,846	10.03

[a] Details of distribution shown in following table.

Chemical lime sold by producers in the United States for "other uses," 1923–24

Use	1923		1924	
	Short tons	Value	Short tons	Value
Acetic acid	13,536	$132,757	----------	----------
Acid neutralization	2,374	39,180	([a])	([a])
Alcohol manufacture and dehydration	([a])	([a])	9,182	$74,324
Alkali works (ammonia, soda, potash)	27,535	244,378	13,351	117,401
Bleaching powder	28,202	287,509	18,723	179,473
Bleach, liquid	----------	----------	15,405	150,222
Calcium acetate	12,833	127,401	4,125	33,062
Calcium carbide	5,513	51,709	14,921	140,196
Coke and gas manufacture (gas purification and plant by-products)	11,889	71,477	25,142	197,122
Creameries and dairies	388	4,242	1,546	31,826
Disinfectants (chloride of lime, etc.)	([a])	([a])	530	3,674
Flour mills	659	9,041	185	2,793
Glue	10,484	97,977	6,469	58,740
Insecticides (spraying materials)	10,972	116,181	11,593	121,365
Oil and fat manufacture	6,256	68,601	3,036	34,709
Paint (kalsomine, whitewash, varnish, etc.)	5,829	55,287	4,756	45,760
Rubber	767	9,162	1,631	19,801
Salt refining	968	8,959	1,480	13,631
Sand-lime and slag brick	14,854	139,945	26,549	231,804
Sanitation (sewage and garbage purification, etc.)	1,473	12,464	7,396	56,326
Silica brick	13,993	117,376	10,495	90,127
Soap	18,186	123,222	32,807	197,272
Textiles	([a])	([a])	2,386	20,772
Water purification	92,406	905,401	113,577	1,073,080
Wood distillation	8,771	84,583	5,871	56,486
Undistributed[b]	15,439	191,289	11,008	118,254
Unspecified	212,969	1,971,622	202,995	1,803,069
	516,296	4,869,763	545,159	4,871,289

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[a] Included under "Undistributed."

[b] 1923: Lime used in alcohol manufacture and dehydration, in baking powder, buffing compounds, candles, corn products, correction of acidity of oil, disinfectants, dyes, explosives, food products, gelatin (edible), ice, magnesia, nitrates, oxygen, pottery, poultry food, and textiles; 1924: Lime used in acid neutralization, artificial silk, asphalt, buffing compounds, corn products, dyes, explosives, food products, gelatin (edible), magnesia, oxygen, proprietary medicines, sheep dip, and snuff.

It is necessary to classify much material as "unspecified," because many of the manufacturers do not report the uses of the part of their lime which they sell for chemical purposes. This lime is known to be applied to several of the uses enumerated, but the figures given are the best available.

The above figures do not include a considerable amount of lime which is not a commercial product but is burned, for use in manufacturing, from stone either quarried or purchased by the manufacturer. This stone is reported to the bureau as raw limestone and is included in the statistics on stone. It is used mainly by alkali works, carbide works, sugar refineries, and smelters.

Lime sold by producers in the United States in 1924, by States and uses

State	Building		Agricultural		Chemical												Total	
					Glass works		Paper mills		Sugar refineries		Tanneries		Metallurgy		Other chemical uses			
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	54, 422	$517, 802	------	------	------	------	(a)	(a)	------	------	(a)	(a)	(a)	(a)	34, 441	$297, 923	204, 059	$1, 812, 282
Arizona	(a)	(a)	(a)	(a)	(a)	(a)	------	------	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	27, 972	331, 756
Arkansas	10, 051	97, 500	(a)	(a)	------	------	(a)	(a)	------	------	------	------	------	------	(a)	(a)	13, 984	131, 108
California	40, 914	447, 535	3, 251	$44, 992	------	------	------	------	(a)	(a)	(a)	(a)	3, 190	$35, 847	8, 607	85, 182	59, 583	658, 138
Colorado	(a)	(a)	------	------	------	------	------	------	------	------	------	------	(a)	(a)	(a)	(a)	(a)	(a)
Connecticut	56, 345	774, 452	(a)	(a)	------	------	(a)	(a)	------	------	------	------	------	------	------	------	58, 851	796, 541
Florida	(a)	(a)	------	------	------	------	------	------	------	------	------	------	------	------	------	------	(a)	(a)
Georgia	(a)	(a)	(a)	(a)	------	------	------	------	------	------	------	------	------	------	------	------	(a)	(a)
Hawaii	(a)	(a)	(a)	(a)	------	------	------	------	(a)	(a)	------	------	------	------	------	------	(a)	(a)
Idaho	(a)	(a)	------	------	------	------	------	------	------	------	------	------	(a)	(a)	(a)	(a)	(a)	(a)
Illinois	44, 587	524, 516	------	------	------	------	12, 217	$112, 462	------	------	(a)	(a)	(a)	(a)	19, 625	180, 576	89, 132	934, 199
Indiana	21, 656	188, 222	5, 157	35, 622	(a)	(a)	29, 184	244, 436	------	------	(a)	(a)	12, 673	105, 405	44, 183	380, 976	116, 927	991, 003
Iowa	(a)	(a)	------	------	------	------	------	------	------	------	------	------	------	------	------	------	(a)	(a)
Kentucky	(a)	(a)	(a)	(a)	------	------	(a)	(a)	(a)	(a)	------	------	(a)	(a)	(a)	(a)	8, 091	58, 228
Maine	77, 258	1, 374, 100	8, 166	40, 424	------	------	34, 551	326, 590	(a)	(a)	(a)	(a)	------	------	(a)	(a)	125, 688	1, 809, 929
Maryland	(a)	(a)	40, 628	355, 776	------	------	------	------	------	------	------	------	------	------	(a)	(a)	56, 178	470, 105
Massachusetts	151, 974	2, 333, 577	4, 928	17, 995	------	------	23, 120	198, 139	------	------	------	------	(a)	(a)	(a)	(a)	194, 402	2, 693, 028
Michigan	12, 416	113, 067	(a)	(a)	------	------	26, 399	261, 117	------	------	2, 180	$21, 551	(a)	(a)	23, 851	227, 757	73, 096	702, 072
Minnesota	19, 412	242, 385	------	------	------	------	(a)	(a)	(a)	(a)	------	------	(a)	(a)	(a)	(a)	25, 764	319, 066
Missouri	82, 051	797, 665	(a)	(a)	(a)	(a)	(a)	(a)	332	$3, 674	1, 600	17, 510	34, 534	297, 766	114, 608	1, 137, 042	243, 465	2, 354, 175
Moutana	(a)	(a)	------	------	------	------	------	------	------	------	------	------	(a)	(a)	(a)	(a)	2, 374	25, 316
Nevada	(a)	(a)	------	------	------	------	------	------	------	------	------	------	------	------	(a)	(a)	(a)	(a)
New Jersey	204	1, 516	------	------	------	------	------	------	------	------	------	------	------	------	------	------	204	1, 516
New Mexico	704	7, 901	------	------	------	------	------	------	------	------	------	------	(a)	(a)	(a)	(a)	2, 389	23, 975
New York	24, 490	228, 478	3, 988	30, 215	(a)	(a)	21, 478	229, 082	(a)	(a)	3, 405	44, 784	10, 994	121, 025	34, 055	336, 409	98, 592	991, 799
North Carolina	(a)	(a)	------	------	------	------	------	------	------	------	(a)	(a)	------	------	------	------	(a)	(a)
Ohio	671, 510	6, 891, 769	19, 686	134, 943	69, 064	$587, 220	17, 871	147, 019	------	------	840	8, 029	8, 718	76, 324	146, 718	1, 665, 966	934, 407	9, 511, 270
Oklahoma	(a)	(a)	------	------	------	------	------	------	------	------	------	------	------	------	------	------	(a)	(a)
Oregon	(a)	(a)	------	------	------	------	------	------	------	------	------	------	(a)	(a)	------	------	(a)	(a)
Pennsylvania	288, 899	2, 500, 901	116, 966	883, 225	602	3, 809	39, 799	310, 777	374	3, 179	9, 995	84, 479	70, 462	431, 873	173, 283	1, 416, 563	700, 380	5, 634, 806
Porto Rico	595	5, 630	1, 371	13, 095	------	------	------	------	6, 186	110, 903	------	------	------	------	112	2, 737	8, 264	132, 365
Rhode Island	(a)	(a)	(a)	(a)	------	------	------	------	------	------	(a)	(a)	------	------	(a)	(a)	(a)	(a)
South Dakota	(a)	(a)	------	------	------	------	------	------	------	------	------	------	(a)	(a)	(a)	(a)	(a)	(a)
Tennessee	73, 496	707, 774	791	5, 407	------	------	41, 166	216, 031	(a)	(a)	1, 811	11, 790	(a)	(a)	22, 325	131, 018	144, 292	1, 111, 781
Texas	44, 017	420, 518	(a)	(a)	(a)	(a)	(a)	(a)	418	3, 940	------	------	(a)	(a)	(a)	(a)	60, 565	570, 334

[a] Included under "Undistributed."

Lime sold by producers in the United States in 1924, by States and uses—Continued

State	Building		Agricultural		Chemical												Total	
					Glass works		Paper mills		Sugar refineries		Tanneries		Metallurgy		Other chemical uses			
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Utah	10,024	$136,478	------	------	------	------	------	------	------	------	------	------	(a)	(a)	(a)	(a)	12,853	$172,434
Vermont	27,923	397,514	829	$4,277	------	------	7,810	$88,538	------	------	6,279	$75,223	3,914	$38,658	9,729	$106,529	56,484	710,739
Virginia	86,161	759,188	19,906	130,571	------	------	6,977	49,687	600	$4,500	10,071	89,312	1,521	11,672	47,540	364,517	172,776	1,409,447
Washington	20,742	266,174	(a)	(a)	------	------	(a)	(a)	1,500	20,196	------	------	(a)	(a)	2,965	36,722	28,188	353,450
West Virginia	29,365	259,785	18,289	122,594	(a)	(a)	(a)	(a)	------	------	(a)	(a)	(a)	(a)	137,176	1,128,572	238,714	1,884,682
Wisconsin	227,978	2,028,839	(a)	(a)	------	------	3,982	37,168	------	------	(a)	(a)	------	------	(a)	(a)	235,030	2,129,701
Wyoming	(a)	(a)	------	------	------	------	------	------	------	------	------	------	------	------	------	------	(a)	(a)
Undistributed	92,506	988,649	4,380	45,378	3,156	$31,427	35,547	307,196	7,651	99,687	17,168	162,455	190,807	1,608,948	54,600	582,057	79,296	871,178
	2,169,700	23,011,935	248,336	1,864,514	72,822	622,456	300,101	2,528,242	17,061	246,079	53,349	515,133	336,813	2,727,518	873,818	8,080,546	4,072,000	39,596,423

[a] Included under "Undistributed."

Building lime.—Sales of lime for construction work, which had increased 49 per cent in 1922 and 15.5 per cent in 1923, increased only 2 per cent in 1924. Demands on producers for building lime differed greatly in the different States. Some producers reported considerable increases, some large decreases, and still others little change from the demand in 1923. Competition was very keen. Only eight of the larger producing States showed increased sales, and these ranged from less than 1 per cent in Pennsylvania to 16 per cent in Massachusetts.

Chemical lime.—Sales of chemical lime in 1924 decreased 3 per cent in quantity. Sales of lime for use in metallurgy and as a refractory decreased because of the diminished activity of iron blast furnaces and smelters in 1924. The quantity of lime sold for use by paper mills, glass works, and tanneries also decreased, but lime sold for use by sugar refineries increased. Among the lime products listed under " other uses " the increase in sales of lime for water purification is noteworthy.

Agricultural lime.—From 1914 through 1923, with the exception of the year 1919, there was a steady decrease in sales of agricultural lime. In 1924 there was an increase of 3 per cent in the quantity as compared with 1923. Sales of pulverized limestone for agricultural purposes increased 6 per cent in quantity in 1924. Of the chief States producing agricultural lime, Ohio, Pennsylvania, and West Virginia reported increases in sales and Maryland and Virginia decreases. Sales of calcareous marl reported used for agricultural purposes decreased 27 per cent in quantity in 1924. More lime was reported burned from oyster shells in 1924 than in 1923. Approximately 185,000 tons of crushed oyster shells were reported as sold during 1924, but the greater part was sold for poultry food and road metal.

Agricultural lime sold by producers in the United States, 1923–24, by kinds

Kind	Short tons		Value	
	Gross	Effective lime content	Total	Average
1923				
Lime from limestone:				
Quicklime	109,108	91,600	$648,882	$5.95
Hydrated	131,443	92,000	1,176,637	8.95
Lime from oyster shells	18,820	15,800	138,530	7.36
Limestone (pulverized)	1,278,770	549,870	2,160,249	1.69
Calcareous marl	99,410	42,700	328,932	3.31
1924				
Lime from limestone:				
Quicklime	119,926	100,700	703,692	5.87
Hydrated	128,410	89,900	1,160,822	9.04
Lime from oyster shells	40,267	33,800	242,789	6.03
Limestone (pulverized)	1,352,600	581,600	2,046,860	1.51
Calcareous marl	72,710	31,200	225,383	3.10

The method by which the effective lime content of the different forms of land lime is calculated was set forth in Mineral Resources for 1921.

Detailed statistics of pulverized limestone sold for agriculture in 1924 are given in the chapter on stone. All the calcareous marl sold in the United States in 1924 was used for liming the soil. Virginia produced 28,940 short tons, valued at $74,059, and West Virginia 17,686 tons, valued at $53,058.

HYDRATED LIME

The statistics of the output of hydrated lime include only the product made in hydrating machines and omit hand-slaked lime. There was an increase of 7 per cent in the quantity of hydrated lime sold in 1924 but a decrease of 2 in the number of plants. The increased sales of hydrated lime were for construction, as the quantities sold for agricultural and chemical uses both decreased.

Hydrated lime sold by producers in the United States, 1915-1924

Year	Number of plants in operation	Short tons	Value	
			Total	Average
1915	84	581,114	$2,457,602	$4.23
1916	89	717,382	3,626,998	5.06
1917	90	709,157	4,643,004	6.55
1918	90	620,216	5,342,113	8.61
1919	93	777,408	7,061,146	9.08
1920	98	853,116	9,287,562	10.89
1921	105	792,970	7,421,637	9.36
1922	114	1,106,063	9,868,980	8.92
1923	121	1,225,928	12,229,598	9.98
1924	119	1,316,664	13,199,846	10.03

Hydrated lime sold by producers in the United States, 1923-24, by uses

Use	1923		1924	
	Short tons	Value	Short tons	Value
Agricultural	131,443	$1,176,637	128,410	$1,160,822
Building	920,203	9,303,586	1,029,384	10,420,151
Chemical:				
Glass works	3,048	38,513	862	10,338
Metallurgy	12,638	117,819	5,765	65,412
Paper mills	15,674	151,276	11,907	119,834
Sugar refineries	2,704	28,460	4,145	51,065
Tanneries	20,093	199,523	18,349	177,062
Other uses	120,125	1,213,784	117,842	1,195,162
Total chemical	174,282	1,749,375	158,870	1,618,873
	1,225,928	12,229,598	1,316,664	13,199,846

Hydrated lime sold by producers in the United States, 1923–24, by States

State	1923		1924	
	Short tons	Value	Short tons	Value
Alabama	19, 526	$173, 571	23, 465	$215, 468
Illinois	15, 590	158, 818	([a])	([a])
Indiana	43, 051	435, 313	44, 697	400, 965
Maryland	34, 783	339, 392	29, 134	274, 195
Missouri	63, 823	674, 848	60, 651	642, 995
Ohio	601, 082	5, 984, 240	654, 763	6, 734, 863
Pennsylvania	177, 836	1, 740, 209	189, 431	1, 727, 749
Tennessee	40, 558	385, 955	44, 242	455, 641
Texas	22, 935	223, 735	25, 496	243, 147
Virginia	32, 189	280, 444	38, 001	334, 393
West Virginia	52, 954	428, 587	44, 841	386, 250
Wisconsin	19, 736	208, 142	18, 246	201, 745
Undistributed [b]	101, 865	1, 196, 344	143, 697	1, 582, 435
	1, 225, 928	12, 229, 598	1, 316, 664	13, 199, 846

[a] Included under "Undistributed."

[b] 1923: Arizona, California, Colorado, Connecticut, Florida, Georgia, Hawaii, Kentucky, Maine, Massachusetts, Michigan, Minnesota, Nevada, New Jersey, New York, Rhode Island, Utah, Vermont, and Washington; 1924: Arizona, California, Colorado, Connecticut, Florida, Georgia, Hawaii, Illinois, Kentucky, Maine, Massachusetts, Michigan, Minnesota, Nevada, New York, Rhode Island, Utah, Vermont, and Washington.

CONSUMPTION

The statistics at hand afford no measure of the actual consumption of lime. The consumption in each State can be determined approximately, however, by estimating the new supply annually made available. In the following table the supply of lime is estimated by subtracting from the production (sales) the quantities reported shipped by producers out of the producing State and adding the quantities reported shipped in by producers in other States. No account is taken of jobbers' or dealers' interstate business nor of producers', jobbers', dealers', or consumers' stocks, which are quite unknown. Foreign trade is largely ignored, but is insignificant in quantity. The estimates are therefore not precise, but afford the best approximations possible. On this basis more than half of the States showed the same or a lower per capita supply in 1924, and the average for the country was slightly lower. The lime produced in Ohio is shipped more widely than that from any other State; that of Missouri and Pennsylvania has the next widest distribution. To publish a table showing the detailed shipments of lime by States is not possible, as such a table would disclose the output of many individual companies. Some of the factors that govern the relations between production, shipments, and consumption are the geographic distribution of large workable deposits of limestone among the States, transportation facilities from the deposits, and the distance from the plants to localities without large deposits of limestone but with centers of population furnishing a market for lime. Small quantities of lime of an exceptional quality may be shipped long distances for special purposes. This is illustrated by the shipments of the finishing limes manufactured in Ohio, and by shipments of certain chemical limes. A State may produce large quantities of lime for which there is little demand within the State, but this lime may go to neighboring States less favored with a supply of limestone. There is also much interstate shipment by reason of the configuration of the country and the availability of transportation lines, which make it easier and cheaper for many consumers to obtain lime from a neighboring State than from their own State.

Lime supplies available for consumption in the United States in 1924, by States, in short tons

State	Sales by producers	Shipments from State	Shipments into State	Supply				
				Total	Hydrated lime	Quicklime	Pounds per capita [a]	
							1923	1924
Alabama	204,059	44,735	8,046	167,370	18,139	149,231	125	136
Alaska	----------	----------	18	18	----------	18	-----	1
Arizona	27,972	17,671	4,302	14,603	1,144	13,459	37	73
Arkansas	13,984	7,822	3,853	10,015	2,808	7,207	14	11
California	59,583	2,700	42,458	99,341	15,057	84,284	53	50
Colorado	(b)	(b)	10,678	19,720	5,038	14,682	36	39
Connecticut	58,851	44,020	31,351	46,182	7,415	38,767	56	61
Delaware	----------	----------	23,522	23,522	10,940	12,582	199	201
District of Columbia	----------	----------	20,554	20,554	12,164	8,390	86	83
Florida	(b)	----------	(b)	45,588	30,003	15,585	71	84
Georgia	(b)	(b)	29,103	38,163	27,390	10,773	25	25
Hawaii	(b)	----------	(b)	6,399	1,442	4,957	38	44
Idaho	(b)	(b)	1,504	2,136	255	1,881	10	9
Illinois	89,132	31,238	302,142	360,036	79,314	280,722	80	104
Indiana	116,927	66,263	60,074	110,738	49,893	60,845	69	73
Iowa	(b)	(b)	46,826	49,580	17,477	32,103	34	40
Kansas	----------	----------	24,458	24,458	12,180	12,278	29	27
Kentucky	8,091	3,142	26,139	31,088	12,016	19,072	25	25
Louisiana	----------	----------	45,500	45,500	14,306	31,194	42	49
Maine	125,688	81,182	25,568	70,074	3,487	66,587	199	179
Maryland	56,178	29,488	65,756	92,446	43,090	49,356	150	121
Massachusetts	194,402	145,968	93,805	142,239	19,830	122,409	68	69
Michigan	73,096	31,856	139,127	180,367	97,133	83,234	85	88
Minnesota	25,764	8,765	15,790	32,789	17,158	15,631	29	26
Mississippi	----------	----------	19,664	19,664	5,431	14,233	18	22
Missouri	243,465	165,710	25,958	103,713	23,045	80,668	63	60
Montana	2,374	----------	1,695	4,069	1,556	2,513	14	13
Nebraska	----------	----------	12,454	12,454	7,048	5,406	23	18
Nevada	(b)	(b)	1,798	3,474	476	2,998	165	90
New Hampshire	----------	----------	16,271	16,271	1,703	14,568	66	72
New Jersey	204	----------	163,019	163,223	94,086	69,137	95	94
New Mexico	2,389	1,215	1,503	2,677	553	2,124	14	14
New York	98,592	37,401	410,186	471,377	171,596	299,781	82	85
North Carolina	(b)	(b)	70,456	74,562	28,951	45,611	51	54
North Dakota	----------	----------	2,959	2,959	1,724	1,235	14	9
Ohio	934,407	658,923	101,368	376,852	151,639	225,213	129	120
Oklahoma	(b)	(b)	15,795	15,947	8,727	7,220	14	14
Oregon	(b)	(b)	5,575	5,688	2,220	3,468	17	14
Pennsylvania	700,380	239,755	250,698	711,323	191,984	519,339	161	154
Porto Rico	8,264	----------	431	8,695	431	8,264	9	12
Rhode Island	(b)	(b)	14,062	16,576	2,767	13,809	62	52
South Carolina	----------	----------	21,754	21,754	9,661	12,093	22	25
South Dakota	(b)	----------	(b)	10,023	3,326	6,697	17	30
Tennessee	144,292	105,242	12,760	51,810	15,249	36,561	45	43
Texas	60,565	13,845	1,154	47,874	22,282	25,592	20	19
Utah	12,853	5,208	270	7,915	1,760	6,155	35	32
Vermont	56,484	51,920	823	5,387	634	4,753	51	31
Virginia	172,776	120,177	35,065	87,664	29,809	57,855	76	72
Washington	28,188	13,712	724	15,200	2,853	12,347	15	21
West Virginia	238,714	221,867	47,958	64,805	15,842	48,963	96	82
Wisconsin	235,030	177,527	49,631	107,134	19,906	87,228	142	77
Wyoming	(b)	----------	(b)	2,149	954	1,195	30	20
Undistributed	79,296	29,003	43,915	----------	----------	----------	-----	-----
	4,072,000	[c]2,356,355	2,348,520	4,064,165	1,313,892	2,750,273	72	71

[a] Based on Bureau of the Census estimates of population for Jan. 1, 1924 and 1925.

[b] Included under "Undistributed."

[c] Includes 6,472 tons shipped to Canada, 383 tons to Mexico, 198 tons to Cuba, 18 tons to Salvador, 16 tons to South America, 120 tons to New Zealand, 450 tons to the Philippine Islands, and 178 tons unspecified, as reported by the shippers.

EXPORTS AND IMPORTS[1]

Lime exported from the United States, 1915-1924

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average			Total	Average
1915	16,223	$106,312	$6.55	1920	5,921	$128,296	$21.67
1916	23,973	132,769	5.54	1921	5,192	109,769	21.14
1917	18,794	168,671	8.97	1922	8,289	116,649	14.07
1918	7,191	105,803	14.71	1923	11,789	170,289	14.44
1919	6,372	108,370	17.01	1924	14,905	212,340	14.25

Lime exported from the United States, 1923-24, by countries

Country	1923		1924	
	Short tons	Value	Short tons	Value
North America:				
Canada	6,895	$83,781	6,647	$83,530
Central America—				
British Honduras	4	73	(a)	3
Costa Rica			2	84
Guatemala			1	29
Honduras	310	5,994	89	1,801
Nicaragua	117	3,251	106	4,262
Panama	94	2,189	132	3,156
Salvador	44	1,787	22	591
Mexico	2,486	34,664	5,137	50,643
Newfoundland and Labrador	5	114	(a)	42
West Indies—				
British—				
Bermuda	27	774		
Jamaica	5	146		
Trinidad and Tobago	(a)	38		
Other British	109	2,820	27	587
Cuba	245	5,100	598	10,791
Dominican Republic	951	18,543	767	19,745
Virgin Islands of the United States	30	843	119	3,094
South America:				
Bolivia	3	60	3	60
Chile	9	217	13	407
Colombia	17	581	77	2,182
Ecuador			30	901
Peru	303	6,772	141	3,450
Venezuela	(a)	20	19	412
Europe:				
Belgium			43	894
England	2	35	4	167
Germany			353	14,126
Scotland			11	227
Sweden	1	50	8	360
Asia:				
China			4	145
Dutch East Indies			1	14
Japan			(a)	4
Philippine Islands	77	1,605	503	9,572
Africa:				
Liberia			6	108
Oceania:				
Australia			14	339
French Oceania			2	83
New Zealand	55	832	26	531
	11,789	170,289	14,905	212,340

[a] Less than 1 ton.

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[1] Statistics of exports and imports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Lime imported for consumption in the United States, 1915–1924 [a]

Year	Short tons	Value	
		Total	Average
1915	1,956	$22,489	$11.50
1916	7,959	71,663	9.00
1917	7,353	70,505	9.59
1918	6,650	73,458	11.05
1919	8,679	128,519	14.81
1920	22,688	$392,137	$17.28
1921	10,811	234,798	21.72
1922	14,112	290,845	20.61
1923	25,407	428,903	16.88
1924	20,480	377,994	18.46

[a] Most of the lime imported into the United States comes from Canada.

PRODUCING LOCALITIES

The Bureau of Mines has received many requests for general information concerning location of plants manufacturing lime of various grades and for various uses. To supply this information a list of the lime-manufacturing plants that report their annual sales of lime to the bureau has been prepared. The States are grouped geographically and a brief statement of conditions in the group dealing chiefly with shipments and consumption of the lime in the States is given. This statement supplements the figures given in the table on page 202. Publication of analyses of the lime and limestone of different manufacturers was intended, but the information received on the schedules in 1924 was not complete enough for the purpose.

NEW ENGLAND STATES

CONNECTICUT, MAINE, MASSACHUSETTS, RHODE ISLAND, VERMONT

In the New England States the production of lime is confined to localities on the Maine coast, northwestern Vermont, western Massachusetts and Connecticut, and northeastern Rhode Island. In this region 32 plants were in operation in 1924 and 11 per cent of the quantity and 15 per cent of the value of the total production in the United States was manufactured by them. About 8 per cent of the product of these plants is hydrated lime, which is produced at 6 plants. Massachusetts is the largest producer of lime in New England, followed by Maine. Connecticut and Vermont produce about equal amounts. In 1924, 72 per cent of the product of these plants was reported as sold for construction work and most of the remainder for chemicals, although a small amount was sold for agriculture. The paper mills consume most of the chemical lime sold. The main markets for the lime produced in each State, as reported, are outside of the State itself, although there is also intrastate shipment. Outside shipments of lime from the New England States in 1924 were chiefly to the New York, Pennsylvania, and New Jersey markets, although there were shipments recorded to Ohio and Canada, and the requirements of New Hampshire, which produces no lime, were supplied from other New England States. The principal States shipping lime into these New England States were New York, Ohio, and Pennsylvania, although shipments were also reported from Indiana, Missouri, Virginia, West Virginia, and Wisconsin. Following are the names of the lime manufacturers in the New England States:

CONNECTICUT

Fairfield County:

New Milford—New England Lime Co. (address, Pittsfield, Mass.); high-magnesium; 9 patent kilns; 80 tons a day; bituminous coal; quicklime (lump), construction, agriculture; open quarry.

Redding—New England Lime Co. (address, Pittsfield, Mass.); high-magnesium; 2 patent kilns; 18 tons a day; bituminous coal; quicklime (lump), construction; open quarry.

Litchfield County:

Canaan—Fred. W. Barhoff (address, Hartford); high-magnesium, low-magnesium; 4 patent kilns; 48 tons a day; bituminous coal and wood; quicklime (lump), construction, agriculture; open quarry.

——— Connecticut Lime Co. (address, Lee, Mass.); high-magnesium; 6 patent kilns; 100 tons a day; bituminous coal; quicklime (lump), construction, chemical, agriculture; open quarry.

East Canaan—New England Lime Co. (address, Pittsfield, Mass.); high-magnesium; 8 patent kilns; 80 tons a day; bituminous coal; quicklime (lump), construction, agriculture; open quarry.

North Canaan—New England Lime Co. (address, Pittsfield, Mass.); P. & F. plant; high-magnesium; 7 patent kilns; 70 tons a day; bituminous coal; quicklime (lump), construction, agriculture; hydrated, mason's, finishing, agriculture; Clyde hydrator; open quarry.

MAINE

Knox County:

Rockland and Rockport—Edward Bryant & Co. (address, Boston, Mass.); high-calcium; 7 patent kilns; 91 tons a day; wood, bituminous coal; quicklime (lump), construction, agriculture; open quarry.

Rockland, Rockport, and Thomaston—Rockland-Rockport Lime Corporation (address, Rockland); high-calcium; 26 flame kilns, 6 gas kilns; 359 tons a day; bituminous coal, producer gas, wood; quicklime (lump, ground), construction, agriculture, chemical; hydrated, mason's, chemical, agriculture; Kritzer modified hydrator; ready-mixed dry plaster; open quarry.

Rockland and Thomaston—New England Portland Cement & Lime Co. (address, Boston, Mass.); plant under construction.

Thomaston—A. J. Bird (address, Rockland); low-magnesium; 1 patent kiln; 8 tons a day; wood; quicklime (lump), construction, agriculture; open quarry.

——— J. A. Creighton & Co.; high-calcium; 9 patent kilns; 72 tons a day; wood; quicklime (lump), construction, agriculture; open quarry.

MASSACHUSETTS

Berkshire County:

Adams—New England Lime Co. (address, Pittsfield); high-calcium; 4 rotary kilns; 165 tons a day; oil; quicklime (granular), construction, chemical; open quarry.

Cheshire—Cheshire Lime Manufacturing Co.; high-calcium; 4 flame kilns; 40 tons a day; coal and wood; quicklime (lump), construction, chemical, agriculture; open quarry.

Farnams—Cheshire Lime Co.; high-calcium; 8 patent kilns, 9 gas kilns; 200 tons a day; producer gas, coal and wood; quicklime (lump), construction, agriculture, chemical; open quarry.

Lee—Lee Lime Co.; high-magnesium; 10 flame kilns; 180 tons a day; bituminous coal; quicklime (lump), chemical; hydrated, mason's, finishing; Kritzer hydrator; open quarry.

Richmond—Pittsfield Lime & Stone Co. (address, New York, N. Y.); high-calcium; 4 patent kilns; 48 tons a day; bituminous coal; quicklime (lump), construction, chemical; open quarry.

Sheffield—Berkshire Hills Co.; high-calcium, low-magnesium; 5 flame kilns; 53 tons a day; bituminous coal and wood; quicklime (lump), construction; open quarry.

West Stockbridge—Clifford L. Miller; high-calcium, low-magnesium; 8 flame kilns; 67 tons a day; bituminous coal; quicklime, construction; hydrated, construction.

Berkshire County—Continued.

West Stockbridge—New England Lime Co. (address, Pittsfield); high-calcium, low-magnesium; 2 flame kilns; 15 tons a day; bituminous coal; quicklime (lump), construction; open quarry.

——— New England Lime Co. (address, Pittsfield); Rockdale plant; low-magnesium; 1 rotary kiln; 33 tons a day; oil; quicklime (granular), construction; open quarry.

——— Tobey Lime Co.; high-calcium; 3 flame kilns, 1 rotary kiln; 18 tons a day; wood, oil; quicklime (lump, granular), construction; open quarry.

Zylonite—Hoosac Valley Lime Co. (Inc.) (address, Adams); high-calcium; 4 patent kilns; 30 tons a day; bituminous coal and wood, wood; quicklime (lump, granular), construction, agriculture.

RHODE ISLAND

Providence County: Lincoln—Burton K. Harris (address, Saylesville); low-magnesium; 3 patent kilns, 1 gas kiln; 25 tons a day; coal and wood; quicklime (lump), construction, chemical; hydrated, mason's, finishing, agriculture; Clyde hydrator; open quarry.

VERMONT

Addison County:

Brandon—Leicester Lime Corporation; high-calcium; 3 patent kilns; 36 tons a day; bituminous coal; quicklime (lump, ground to 20 mesh), construction, chemical; open quarry.

Leicester Junction—Brandon Lime & Marble Co.; high-calcium; 2 patent kilns; 20 tons a day; bituminous coal; quicklime (lump), construction, agriculture, chemical; open quarry.

Middlebury—Green Mountain Lime Corporation (address, care of Brewer & Co., Worcester, Mass.); high-calcium; 5 pot kilns; 50 tons a day; bituminous coal; quicklime (lump), construction, agriculture, chemical; open quarry.

Crittendon County: Winooski—Champlain Valley Lime Co. (address, care of Brewer & Co., Worcester, Mass.); high-calcium, low-magnesium; 3 pot kilns; 30 tons a day; bituminous coal and wood; quicklime (lump, ground), construction, chemical; open quarry.

Franklin County:

High Gate Springs—Missisquoi Lime Works (Inc.); high-calcium, low-magnesium; 4 pot kilns, 2 patent kilns; 45 tons a day; wood and bituminous coal; quicklime, construction, chemical.

St. Albans—Fonda Lime Kilns; high-calcium; construction, chemical.

Swanton—Swanton Lime Works; high-calcium; 5 gas kilns; 50 tons a day; producer gas; quicklime (lump), construction, chemical; open quarry.

Rutland County:

Danby—Vermont Lime Products Co.; high-calcium; 3 patent kilns; coal and wood; quicklime, construction, chemical.

West Rutland—Vermarco Lime Co.; high-calcium; 2 rotary kilns; 120 tons a day; oil; quicklime (granular), construction, chemical; hydrated, mason's, finishing, chemical, agriculture; Kritzer hydrator; tunnel quarry.

Windsor County: Amsden—Amsden Lime Co. (address, Felchville); high-magnesium; 3 patent kilns; 30 tons a day; wood; quicklime (lump), construction; open quarry; another kiln will be erected and hydrator installed in 1925.

NORTH ATLANTIC STATES

NEW JERSEY, NEW YORK, PENNSYLVANIA

Pennsylvania produced 88 per cent of the lime manufactured in the North Atlantic States and 17 per cent of the total for the United States in 1924. The product is both high-calcium and high-magnesium lime. Prior to 1922 Pennsylvania ranked first among the States that manufacture lime, but in that year Ohio took first place chiefly because of its production of finishing hydrates, but also because of the decrease in sales of agricultural lime, which forms a large part of the lime made in Pennsylvania. There were 136 lime plants in operation in Pennsylvania in 1924, but the output of a large part of these—probably 70 per cent—was used almost wholly for local supply. The number of plants of this kind has been generally decreasing for several years due to lack of common laborers, fuel and labor costs, and substitution of patent fertilizers and of pulverized limestone as a soil corrector. In 1924, 42 per cent of the output of the lime kilns of the State was sold for chemical purposes, including metallurgical processes—mainly iron blast furnaces, steel plants, wire-drawing works, and electric furnaces—and lime used by paper mills, tanneries, etc. Lime sold for construction amounted to 41 per cent of the total and the rest was for agriculture. The quantity used for agriculture increased about 4 per cent in 1924.

Next to Ohio and Missouri, the lime manufactured in Pennsylvania was more widely distributed than that of any of the other States. Sixty-six per cent of the output was consumed within the State, and the largest shipments were made to New York, New Jersey, and Ohio. Other States receiving lime from Pennsylvania were principally those of the eastern coast. Pennsylvania received more lime from Ohio than it shipped there, and also received lime from Indiana, Maine, Maryland, Massachusetts, Missouri, New York, Vermont, Virginia, and West Virginia. The amount reported as shipped from the State was 4 per cent less than that shipped in, and the total supply was 1.6 per cent more than the total sales of domestic manufacture. Pennsylvania produced 71 per cent less hydrated lime than Ohio, but ranked next to Ohio in the total production for the United States. Fifty-nine per cent of the hydrated lime sold in Pennsylvania in 1924 was for construction, and 35 per cent for agriculture.

Of the lime manufactured in New York in 1924, 71 per cent was for chemical use, chiefly in metallurgical works as a refractory, by paper mills, and by tanneries. Most of the building lime in New York was supplied by the large quantities shipped from the New England States, Ohio, mainly hydrated lime, Pennsylvania, and the Middle Atlantic States, with small shipments from some of the Central States. New York shipped out of the State 38 per cent of its production, chiefly to Ohio, Pennsylvania, and the New England States, but the amount consumed in the State was nearly five times the sales of the lime produced in the State.

New Jersey produces a very small quantity of lime, chiefly for local use, but large quantities are shipped into the State from Ohio, chiefly hydrated, and Pennsylvania, and smaller quantities from New York, the New England States, the Middle Atlantic States, and some of the Central States.

The lime-manufacturing plants in the North Atlantic States are as follows:

NEW YORK

Clinton County: Chazy—Chazy Marble Lime Co. (Inc.); high-calcium; 8 pot kilns; 80 tons a day; bituminous coal; quicklime (lump), construction, chemical; open quarry.

Dutchess County: Dover Plains—Kelley Island Lime & Transport Co. (address, Cleveland, Ohio); high-magnesium; 6 patent kilns; 60 tons a day; bituminous coal; quicklime (lump), construction; hydrated, mason's, finishing, agriculture; Clyde hydrator.

Erie County: Buffalo—Kelley Island Lime & Transport Co. (address, Cleveland, Ohio); high-calcium; 2 rotary kilns; 100 tons a day; producer gas; quicklime (pebble), construction, chemical; hydrated, mason's, chemical, agriculture; Schaffer hydrator. Stone burned at this plant is not quarried in New York, but comes from quarries at Calcite, Mich.

Fulton County:

Gloversville—Willard A. Kegg; 1 pot kiln; 7 tons a day; wood; quicklime (lump), chemical; open quarry.

Mayfield—Merl Haines; wood; quicklime (lump), chemical.

Jefferson County: Natural Bridge—Basic Refractories Corporation (address, York, Pa.); high-magnesium; 2 rotary kilns; 80 tons a day; bituminous coal; dead-burned dolomite.

Niagara County: Niagara Falls—Union Carbide Co. (address, New York); high-calcium; 3 rotary kilns; 180 tons a day; bituminous coal; quicklime (lump), chemical; stone not quarried in New York, but purchased from quarry companies in Michigan and Ohio. Lime used by producing company.

Seneca County: Seneca Falls—George M. Fisher; small plant for local supply.

Ulster County:

Accord—H. L. Devoe; small plant for local supply, chiefly for agriculture.

Hurley—Ralph F. Hiller; low-magnesium; 2 pot kilns; anthracite; quicklime, agriculture; small plant for local supply.

Rosendale—A. J. Snyder & Co.; high-calcium; 8 pot kilns; agriculture; supply chiefly local market. Idle 1924.

Warren County:

Glens Falls—Finch, Pruyn & Co. (Inc.); high-calcium, low-magnesium; 3 field kilns; 60 tons a day; wood; quicklime, construction, agriculture, chemical.

——— F. W. Wait Lime Co.; high-calcium; 5 patent kilns; 60 tons a day; bituminous coal; quicklime (lump), construction, agriculture, chemical; open quarry.

Washington County: Smiths Basin—Keenan Lime Co.; high-calcium; 5 patent kilns; 34 tons a day; bituminous coal; quicklime (lump), finishing, construction, agriculture, chemical.

NEW JERSEY

Hunterdon County: Clinton—M. C. Mulligan; small plant for local supply.

Morris County: Vernoy (P. O., Califon)—E. J. Neighbour; high-magnesium; 4 pot kilns; anthracite (pea); quicklime (lump), agriculture; open quarry.

Somerset County: Peapack—Todd & Cordes; high-magnesium; 2 pot kilns; 15 tons a day; coal; quicklime.

Warren County: Carpentersville—Twining & Large Lime & Chemical Co.; high-magnesium; 3 pot kilns; 24 tons a day; anthracite; quicklime; hydrating plant. Idle 1924.

PENNSYLVANIA

Adams County: Hanover—Steacy & Wilton Co. (address, Wrightsville); high-calcium; 6 pot kilns, 4 flame kilns; 82 tons a day; bituminous coal, coke; quicklime, construction, agriculture; hydrated, construction, agriculture, chemical; Clyde hydrator.

Armstrong County: Small plants for local supply.

Bedford County:

Hyndman—Enterprise Lime & Ballast Co.; low-magnesium; 4 pot kilns; 40 tons a day; bituminous coal and coke; quicklime (lump, granular), construction, agriculture; tunnel quarry.

Other small plants for local supply.

Berks County:

Temple—Dietrick Bros. (address, Reading); high-magnesium; 5 pot kilns, 2 flame kilns; 45 tons a day; anthracite and bituminous coal; hydrated, mason's, agriculture; Clyde hydrator; tunnel quarry.

Wernersville—Wernersville Lime & Stone Co.; low-magnesium; 3 pot kilns; 15 tons a day; coke; hydrated, agriculture; own make of hydrator.

Other small plants for local supply.

Blair County:

Duncansville—Duncansville Lime & Stone Co.; high-calcium, low-magnesium; 2 pot kilns; 12 tons a day; bituminous coal, wood; quicklime (lump), agriculture.

Frankstown—American Lime & Stone Co. (address, Bellefonte); high-calcium; 5 flame kilns; 40 tons a day; bituminous coal; quicklime (lump), agriculture, chemical; open quarry.

Hollidaysburg—Calcium Products Co.; 3 gas kilns; 60 tons a day. Idle 1924.

Tyrone—American Lime & Stone Co. (address, Bellefonte); high-calcium, low-magnesium; 5 pot kilns; 20 tons a day; bituminous coal; hydrator. Idle 1924.

Other small plants for local supply.

Bucks County: Small plants for local supply.

Butler County: Wick—Climax Lime & Stone Co.; high-calcium; 9 pot kilns; 45 tons a day; bituminous coal; agriculture.

Cambria County: Johnstown—Schry & Nightengale (address, Conemaugh); high-calcium, low-magnesium; 3 pot kilns; 10 tons a day; bituminous coal; agriculture.

Center County:

Bellefonte—American Lime & Stone Co. (Buffalo Run-Armour Gap plant); high-calcium; 43 flame kilns, 1 rotary kiln; 360 tons a day; bituminous coal, producer gas; quicklime (lump, ground), construction, agriculture, chemical; hydrated, mason's, chemical, agriculture; Schaffer hydrator; stone taken from both open quarry and mines.

——— Centre County Lime Co.; high-calcium; 6 flame kilns; 80 tons a day; bituminous coal; quicklime (lump), construction, agriculture, chemical; open quarry.

——— Chemical Lime Co.; high-calcium; 10 flame kilns; 125 tons a day; bituminous coal; quicklime (lump), construction, agriculture, chemical; hand-mix hydrating; open quarry.

——— Valley View Lime Co.; high-calcium; 2 flame kilns; 14 tons a day; bituminous coal; quicklime (lump), agriculture, chemical; hand-mix hydrating; open quarry.

——— Whiterock Quarries; high-calcium; 18 flame kilns; 125 tons a day; bituminous coal and wood; quicklime (lump), construction, agriculture, chemical; installing Kritzer hydrator for 1925.

Other small plants for local supply.

Chester County:

Devault—Charles Warner Co. (address, Wilmington, Del.); high-magnesium; 15 flame kilns, 1 gas kiln, 1 rotary kiln; 300 tons a day; bituminous coal, producer gas; quicklime (lump), construction, agriculture, chemical; hydrated, mason's, chemical, agriculture; Clyde hydrator; open quarry; ready-mixed dry plaster.

Malvern—Knickerbocker Lime Co. (address, Philadelphia); high-magnesium; 11 flame kilns; 300 tons a day; bituminous coal; quicklime (lump), construction, chemical; hydrated, mason's, agriculture, chemical; Schaffer hydrator; ready-mixed dry plaster; open quarry.

Columbia County:

Almedia—H. N. White; high-calcium; 2 pot kilns; 15 tons a day; anthracite; quicklime (lump), agriculture; open quarry.

Bloomsburg—B. W. Hess; 3 field kilns; quicklime, agriculture.

———Low Bros. & Co.; low-magnesium; 11 pot kilns; 45 tons a day; anthracite; quicklime (lump), agriculture. This company also sells lime to a hydrating company.

——— John F. Summers; agriculture; small plant.

Other small plants for local supply.

Cumberland County:

Carlisle—Goodyear Bros.; agriculture; small plant for local supply.

Newville—W. I. Spangler; low-magnesium; 3 pot kilns; 12 tons a day; coke; quicklime (ground to 16 mesh), agriculture.

Other small plants for local supply.

Dauphin County:

Hershey—Reinhard Lime Works (address, Lebanon); high-calcium; 3 pot kilns; 15 tons a day; coke; quicklime, agriculture; open quarry.

Harrisburg—J. M. Whittock; high-calcium; 4 pot kilns; 30 tons a day; coke; quicklime (lump), agriculture.

Dauphin County—Continued.

Paxtang—Bonnymead Farms (address, Harrisburg); high-calcium; 4 pot kilns; 20 tons a day; coke and anthracite screenings; quicklime (lump), construction, agriculture, chemical; open quarry.

Swatara—Walter T. Bradley (address, Philadelphia); high-calcium; 7 draw kilns; 35 tons a day; anthracite; quicklime (lump), chemical.

Other small plants for local supply.

Fayette County: Small plants for local supply.

Franklin County: Small plants for local supply.

Huntingdon County:

Orbisonia—E. I. Grove; small plant for local supply.

Union Furnace—American Lime & Stone Co. (address, Bellefonte); high-calcium; 10 flame kilns; 70 tons a day; bituminous coal; agriculture. Idle 1924.

Other small plants for local supply.

Jefferson County: Small plants for local supply.

Juniata County: Small plants for local supply.

Lancaster County:

Bainbridge—J. E. Baker Co. (address, York); high-calcium, low-magnesium, high-magnesium; 10 pot kilns, 62 flame kilns, 2 rotary kilns; 310 tons a day; bituminous coal, coke; quicklime (lump), dead-burned dolomite, chemical; hydrated, mason's; Clyde batch hydrator; open quarry.

Lime Rock—Ramoth Lime & Stone Co. (address, Lebanon); high-calcium; 4 pot kilns; 40 tons a day; coke; quicklime (lump), agriculture, chemical; open quarry.

Other small plants for local supply.

Lawrence County:

Ellwood City—Consolidated Stone & Mining Co. (address, Newcastle); low-magnesium; 2 pot kilns; 30 tons a day; bituminous coal; quicklime (lump, ground), agriculture, chemical; hydrated, mason's, agriculture; Clyde hydrator; open quarry.

Rose Point—Rose Point Lime & Stone Co. (address, Newcastle); high-calcium; 10 patent kilns; 150 tons a day; bituminous coal; quicklime (lump, ground), agriculture; hydrated, construction, agriculture.

Wampum—Crescent Portland Cement Co.; 5 pot kilns; 20 tons a day; quicklime. Idle 1924.

Lebanon County:

Annville—Annville Lime Co.; high-calcium, low-magnesium; 6 pot kilns; 30 tons a day; coke; hydrated, agriculture; Clyde hydrator; open quarry.

——— H. E. Millard; high-calcium; 5 pot kilns; 20 tons a day; coke; quicklime (lump), chemical, agriculture; open quarry.

Lebanon—S. J. Lightner; high-calcium; 2 pot kilns; 16 tons a day; coke; quicklime (lump), agriculture, chemical; open quarry.

——— Thomas A. Wagner; low-magnesium; 5 pot kilns; 35 tons a day; coke; quicklime (lump), construction, agriculture, chemical; open quarry.

Myerstown—John Ebling; high-calcium; 6 pot kilns; 15 tons a day; coke; quicklime (lump), chemical; open quarry.

——— I. W. Peifer (address, Lebanon); high-calcium; 4 pot kilns; 28 tons a day; coke; quicklime (lump), agriculture, chemical; open quarry.

Palmyra—Walter T. Bradley (address, Philadelphia); high-calcium; 13 draw kilns; 75 tons a day; anthracite; quicklime (lump), agriculture, chemical; open quarry.

Other small plants for local supply.

Lehigh County:

Allentown—Trexler Lime & Supply Co.; high-magnesium; 4 pot kilns; 20 tons a day; quicklime (lump), construction.

Trexlertown—Irving I. Stettler; high-calcium; 3 pot kilns; 5 tons a day; anthracite; quicklime, agriculture.

Lycoming County:

Jersey Shore—Pine Creek Lime & Stone Co.; high-calcium; 6 pot kilns; 15 tons a day; anthracite; quicklime (lump, ground), agriculture; hydrated, agriculture; Clyde hydrator; open quarry.

Lycoming County—Continued.

Muncy—Henry Kilgus; high-calcium; 6 pot kilns; 18 tons a day; coal; quicklime (lump), agriculture.

——— Reeder Lime & Stone Co.; high-calcium; 24 pot kilns; 65 tons a day; anthracite; quicklime (lump, ground to 16 mesh), agriculture; open quarry.

Williamsport—West Branch Lime Co.; low-magnesium; 7 pot kilns; 25 tons a day; anthracite; quicklime (lump, ground to 10 mesh), agriculture; hydrated, agriculture.

Other small plants for local supply.

Mifflin County: Lewistown—Mifflin County Lime & Stone Co.; high-calcium; 2 pot kilns; 6 tons a day; anthracite screenings; quicklime (lump), agriculture.

Monroe County: Small plants for local supply.

Montgomery County:

Bridgeport—Pennsylvania Lime Products Co. (address, Philadelphia); low-magnesium, high-magnesium; 4 pot kilns; 36 tons a day; bituminous coal; quicklime, hydrated lime.

——— Charles Warner Co. (address, Wilmington, Del.); McCoy plant; high-magnesium; 2 flame kilns; 70 tons a day; bituminous coal; quicklime (lump, ground), construction, agriculture, chemical; hydrated, construction, chemical, agriculture; Kritzer hydrator; open quarry.

Flourtown—Blue Bell Lime Co.; high-magnesium; 6 pot kilns; 30 tons a day. Idle 1924.

Norristown—Merion Lime & Stone Co.; high-magnesium; 7 flame kilns; 100 tons a day; anthracite and bituminous coal; quicklime (lump), agriculture, chemical, construction; hydrated, mason's, chemical, agriculture; pug mill hydrator; dry ready-mixed plaster; open quarry.

Plymouth Meeting—G. & W. H. Corson; high-magnesium; 3 pot kilns, 4 patent kilns; 50 tons a day; coke, bituminous coal; quicklime (lump), agriculture, construction; hydrated, mason's, chemical, agriculture; Clyde hydrator; open quarry.

——— Cox Lime & Stone Co.; high-magnesium; 4 flame kilns, 2 rotary kilns; 54 tons a day; bituminous coal.

Willow Grove—John J. Cannon; high-magnesium; 2 pot kilns; 15 tons a day; bituminous coal; quicklime (lump), construction, agriculture; open quarry.

Montour County:

Danville—Alonzo Mauser; 3 pot kilns; 20 tons a day; anthracite; quicklime, agriculture.

——— McMahan & Bangs; quicklime, agriculture.

Other small plants for local supply.

Northampton County:

Easton—Easton Lime Co.; high-magnesium; 3 flame kilns; 13 tons a day; bituminous coal. Idle 1924.

Portland—Luther Keller Co.; high-magnesium; 11 pot kilns; 35 tons a day; wood; quicklime, agriculture, construction.

Northumberland County: Small plants for local supply.

Perry County:

Landisburg—Dyson & Rice; 1 pot kiln; coke; quicklime, agriculture; open quarry.

Other small plants for local supply.

Schuylkill County: Small plants for local supply.

Snyder County: Small plants for local supply.

Somerset County:

Elk Lick—Keystone Lime & Coal Co.; low-magnesium; 4 pot kilns; 20 tons a day; bituminous coal; quicklime (lump), agriculture; open quarry.

Other small plants for local supply.

Union County:

Winfield—Vance Co.; high-calcium; 17 pot kilns; 35 tons a day; anthracite; quicklime, agriculture; open quarry.

Other small plants for local supply.

Westmoreland County:

Ligonier—Naugle Lime Co.; high-calcium; 1 pot kiln; 6 tons a day; bituminous coal; quicklime, agriculture; open quarry.

Other small plants for local supply.

York County:

Hellam—Emig Lime Co.; high-calcium; 6 pot kilns; 18 tons a day; anthracite; quicklime (lump), agriculture; open quarry.

Mount Wolf (Saginaw)—J. E. Baker Co. (address, York); high-magnesium; 10 flame kilns; 70 tons a day; coke; dead-burned dolomite; open quarry.

Thomasville—J. E. Baker Co. (address, York); high-calcium, low-magnesium; 2 pot kilns, 8 patent kilns; 65 tons a day; bituminous coal; quicklime, construction, agriculture, chemical; open quarry.

——— Thomasville Stone & Lime Co.; high-calcium, low-magnesium; 14 flame kilns; 100 tons a day; bituminous coal; quicklime (lump), construction, agriculture, chemical; open quarry.

York—Palmer Lime & Cement Co. (address, New York, N. Y.); high-calcium, low-magnesium; 3 pot kilns, 10 flame kilns, 2 gas kilns; 251 tons a day; bituminous coal, producer gas; quicklime (lump), construction, chemical, agriculture; hydrated, mason's, chemical, agriculture; open quarry.

——— United States Gypsum Co. (address, Chicago, Ill.); high-calcium, low-magnesium; 12 flame kilns; 75 tons a day; bituminous coal; quicklime (lump, pebble), construction; hydrated, mason's; Clyde hydrator; open quarry and tunnel.

SOUTHEAST ATLANTIC STATES

FLORIDA, GEORGIA, MARYLAND, NORTH CAROLINA, VIRGINIA, WEST VIRGINIA

In Florida the production of lime is confined to one small area near Ocala. The product is a high-calcium lime, used for construction, and is all consumed within the State. In 1924 Florida received lime from Alabama, Georgia, Missouri, Ohio, and Tennessee.

The one lime-burning plant in Georgia is in the northwestern part of the State and produces a high-magnesium lime used chiefly for construction. In 1924 lime was shipped from Georgia to all the bordering States, and lime was shipped into Georgia from Alabama, Ohio, Pennsylvania, and Tennessee.

Most of the lime manufactured in Maryland is used for agriculture, the State ranking second in 1924 in sales of this class of lime. Besides the commercial lime there is a small production by farmers who burn for local use on farms. The output of this lime is much smaller than it was, because many operators have abandoned their kilns on account of cost of production. In 1924 the supply of lime in Maryland was somewhat less than half of the lime it produced. Shipments were confined to neighboring States, New Jersey, and New York. Most of the lime entering the State came from Ohio, Pennsylvania, Virginia, and West Virginia.

High-calcium lime, used mostly for construction, is manufactured in the southwestern part of North Carolina. Most of it is consumed within the State. The chief sources of supply of the lime used in the State in 1924 were Ohio (hydrated lime), Tennessee, and Virginia. Smaller amounts were shipped from Alabama, Georgia, Maryland, Missouri, Pennsylvania, and West Virginia.

Lime is manufactured in Virginia along the western border of the State and in the north. The product is sold chiefly as chemical and building lime, but Virginia is one of the few States producing a considerable quantity of agricultural lime. The supply in Virginia in 1924 was about 30 per cent of the lime produced. The largest shipments were made to Maryland, New Jersey, New York, North Carolina, and Pennsylvania. Smaller quantities were sent to Connecticut, Delaware, District of Columbia, Ohio, and West Virginia, with scattered shipments to Indiana, Kentucky, Maine, Massachusetts, Michigan, Rhode Island, and South Carolina.

West Virginia produces more lime than any other Southeast Atlantic State. Outside of small operations for local agricultural supply, lime burning is confined to the extreme northeastern part of the State, in the limestone belt that extends from the southeastern part of Pennsylvania across Maryland and West Virginia and into Virginia. Both high-calcium and magnesian lime are manufactured in the State, and in 1924 80 per cent of it was sold as chemical lime, chiefly to iron and steel plants. Lime for construction and for agricultural purposes was also sold. Ninety-three per cent of the lime made in 1924 was shipped from the State; the largest market was in Pennsylvania, but considerable amounts were shipped to neighboring States, to the New England and North Atlantic States, and to some of the Central States. The largest amounts shipped into the State were from Ohio and Virginia, with small amounts from Pennsylvania and some of the Central States.

The lime-manufacturing plants in the Southeast Atlantic States are as follows:

FLORIDA

Marion County:
- Ocala—Florida Lime Co.; high-calcium; 5 kilns; 25 tons a day; wood; quicklime (lump), construction; hydrated, mason's, finishing; Clyde hydrator.
- Reddick—Commercial Lime Co. (address, Ocala); high-calcium; 10 shaft kilns; 50 tons a day; wood; quicklime (lump), construction; hydrated, mason's; Clyde hydrator; open quarry.

GEORGIA

Bartow County: Cartersville—Ladd Lime & Stone Co.; high-magnesium; 8 pot kilns; 80 tons a day; bituminous coal; quicklime (lump), construction, agriculture; hydrated, mason's, finishing; Clyde hydrator; open quarry.

MARYLAND

Allegany County: Small plants for local supply.

Baltimore County:
- Texas—W. P. Lindsay; high-calcium; 4 pot kilns; 18 tons a day; bituminous coal and wood; quicklime, construction; open quarry. Lessee plant of Maryland Calcite Co.
- Other small plants for local supply.

Carroll County:
- Union Bridge—Tidewater Portland Cement Co. (address, Baltimore); high-calcium, low-magnesium; 6 flame kilns; 75 tons a day; bituminous coal; quicklime (lump), construction, agriculture, chemical; hydrated, construction, agriculture, chemical; Kritzer hydrator; open quarry.
- Wakefield—John S. Hyde (address, Westminster); low-magnesium; 3 pot kilns; 10 tons a day; anthracite; quicklime (lump), agriculture, construction; open quarry.

Frederick County:
- Buckeystown—O. J. Keller Lime Co. (address, Frederick); high-calcium; 7 pot kilns; 90 tons a day; coke; quicklime (lump), construction, chemical; hydrated, mason's, chemical, agriculture; Clyde hydrator; open quarry.
- Fountain Rock—Fountain Rock Lime Co. (address, Woodsboro); high-calcium; 8 pot kilns; 25 tons a day; anthracite; quicklime, construction; hydrated, construction.

Frederick County—Continued.

Frederick (near)—M. J. Grove Lime Co. (address, Lime Kiln); low-magnesium; 16 pot kilns, 4 flame kilns; 115 tons a day; coke; quicklime (lump, ground), construction, agriculture; hydrated, mason's, agriculture; open quarry.

——— Shank & Etzler; high-magnesium; 6 pot kilns; 25 tons a day; anthracite and coke; quicklime (lump, ground to 20 mesh), agriculture; hydrated, agriculture; open quarry.

LeGore—LeGore Lime Co.; high-calcium; 17 pot kilns; 200 tons a day; anthracite; quicklime (lump, ground to 20 mesh), agriculture; hydrated, mason's, agriculture; Schaffer continuous hydrator; open quarry.

Woodsboro—S. W. Barrick & Sons; high-calcium, low-magnesium; 20 pot kilns; 150 tons a day; anthracite; quicklime, agriculture; hydrated, agriculture.

Other small plants for local supply.

Garrett County: Small plants for local supply.

Washington County:

Cavetown—Geo. M. Bushey & Sons (Inc.); high-calcium; 6 pot kilns; 40 tons a day; coke; quicklime, construction, agriculture.

Keedysville—D. D. Keedy; small plant for local supply.

NORTH CAROLINA

Henderson County: Fletcher—Blue Ridge Lime Co.; high-calcium; 4 patent kilns; 20 tons a day; bituminous coal; quicklime (lump), construction.

VIRGINIA

Augusta County:

Staunton—Staunton Lime Products Co. (Inc.); low-magnesium; 2 flame kilns; 20 tons a day; anthracite and coke breeze; quicklime (lump, ground to 16 mesh), agriculture, construction, chemical; open quarry.

Other small plants for local supply.

Botetourt County:

Eagle Rock—Eagle Rock Lime Co.; high-calcium; 4 flame kilns; 40 tons a day; bituminous coal; quicklime (lump), construction, chemical; hydrated, mason's; Schaffer hydrator; open quarry.

——— Moore Lime Co.; high-calcium; 5 flame kilns; 60 tons a day; bituminous coal; quicklime (lump), agriculture; hydrated, mason's, chemical, agriculture; Clyde hydrator; open quarry and tunnel.

Indian Rock—E. Dillon's Sons (Inc.); high-calcium; 3 flame kilns; 45 tons a day; wood; quicklime, construction, chemical; hydrated, construction, agriculture.

Frederick County:

Cedar Creek and Vaucluse Station—Lloyd N. Connor; construction.

Stephens City—M. J. Grove Lime Co. (address, Lime Kiln, Md.); high-calcium; 20 gas kilns; 200 tons a day; bituminous coal; quicklime (lump, ground), construction, agriculture, chemical; hydrated, mason's, chemical, agriculture; Schaffer hydrator; open quarry.

Giles County:

Kerns—Kimbalton Lime Co.; high-calcium; 3 flame kilns; 40 tons a day; quicklime (lump), construction, chemical; hydrated, mason's, agriculture; batch hydrator; open quarry.

Ripplemead—New River Lime Co.; high-calcium; 4 pot kilns; 15 tons a day; bituminous coal; quicklime (lump), agriculture, chemical; open quarry.

Loudoun County: Leesburg—Leesburg Lime Co.; low-magnesium; 5 flame kilns; 50 tons a day; bituminous coal; quicklime (lump, ground to 20 mesh), agriculture; open quarry.

Montgomery County: Vicker—Eureka Coal Co.; high-calcium; 1 pot kiln; 3 tons a day; anthracite; quicklime (lump), construction; open quarry.

Rockingham County:

Harrisonburg—Harrisonburg Lime & Stone Corporation; high-calcium; 2 flame kilns; 20 tons a day; bituminous coal; quicklime (lump), construction, agriculture; open quarry.

Linville—Rockdale Lime Co. (address, Toms Brook); high-calcium; 2 flame kilns; 18 tons a day; bituminous coal and wood; quicklime (lump), ground to 50 mesh), construction, agriculture, chemical; open quarry.

Other small plants for local supply.

Shenandoah County:

Oranda—Palmer Lime & Cement Co. (address, New York, N. Y.); high-calcium; 8 flame kilns; 65 tons a day; bituminous coal; quicklime (lump), construction, chemical; open quarry.

Strasburg—Strasburg Lime Co.; high-calcium; 4 patent kilns; 40 tons a day; bituminous coal; quicklime (lump), mason's, chemical, agriculture; tunnel quarry.

——— Washington Building Lime Co. (address, Baltimore, Md.); high-calcium, low-magnesium; 4 pots kilns, 6 patent kilns; 120 tons a day; bituminous coal, coke; quicklime (lump, ground), construction, agriculture, chemical; open quarry.

Strasburg Junction—Powhatan Lime Co.; high-calcium; 4 pot kilns, 6 patent kilns; 100 tons a day; bituminous coal and wood; quicklime (lump, ground), construction, agriculture, chemical; hydrated, mason's, agriculture, chemical; Clyde and Atlas hydrators; open quarry.

——— Shenandoah Lime Co. (Inc.); high-calcium; 4 flame kilns; 40 tons a day; bituminous coal and wood; quicklime (lump), construction, chemical; open quarry.

Toms Brook—Rockdale Lime Co. (Inc.); high-calcium; 6 flame kilns; 60 tons a day; quicklime (lump, ground), construction, agriculture, chemical; open quarry.

Other small plants for local supply.

Tazewell County:

Maxwell—Blue Grass Lime Co.; high-calcium, low-magnesium; 3 pot kilns; 24 tons a day; bituminous coal; quicklime (lump), agriculture.

North Tazewell—Peery Lime Co.; high-calcium; 4 pot kilns; 12 tons a day; bituminous coal; quicklime, construction; hydrated, mason's, agriculture; Clyde hydrator; open quarry.

——— Tazewell White Lime Works; high-calcium; 1 flame kiln; 6 tons a day; bituminous coal; quicklime (lump), construction, agriculture; open quarry.

Tazewell—Five Oaks Lime & Stone Co.; high-calcium; 1 patent kiln; 10 tons a day; bituminous coal; quicklime, construction, agriculture, chemical; open quarry.

Warren County:

Front Royal—Limeton Lime Co.; high-calcium; 3 flame kilns; 30 tons a day; wood and coal; quicklime (lump), agriculture, chemical; hydrated, mason's, agriculture; Schulthess hydrator; open quarry.

Riverton—Riverton Lime Co. (Inc.); high-calcium, low-magnesium; 5 flame kilns, 3 gas kilns; 120 tons a day; bituminous coal, producer gas; quicklime (lump, granular, ground to 30 mesh), construction, agriculture; hydrated, mason's, agriculture; Carson hydrator; open quarry.

WEST VIRGINIA

Berkeley County:

Jones Springs—J. H. Wheeler (address, Hedgesville); high-calcium; 2 pot kilns; quicklime, agriculture.

Martinsburg—Blair Limestone Co. (address, Pittsburgh, Pa.); high-calcium; 19 pot kilns; 285 tons a day; coke; quicklime (lump), chemical; hydrated, mason's, agriculture; Kritzer hydrator; open quarry.

——— North American Cement Corporation (address, Hagerstown, Md.) (Security Cement & Lime Co. plant); high-calcium; 3 gas kilns; producer gas; quicklime (lump, ground to 20 mesh), agriculture, chemical; hydrated, mason's, chemical, agriculture.

Jefferson County:

Bakerton—Washington Building Lime Co. (address, Baltimore, Md.); high-calcium, low-magnesium; 6 pot kilns, 22 flame kilns; 304 tons a day; bituminous coal, coke; quicklime (lump, ground), construction, agriculture, chemical; hydrated, mason's, chemical, agriculture; batch and continuous hydrators; open quarry and mine.

Millville—Blair Limestone Co. (address, Pittsburgh, Pa.); high-magnesium; 10 pot kilns; 150 tons a day; coke; quicklime (granular), chemical, agriculture; open quarry.

——— Standard Lime & Stone Co. (address, Baltimore, Md.); high-magnesium; 2 rotary kilns; dead-burned dolomite.

Preston County: Small plants for local supply.

NORTHEAST CENTRAL STATES

ILLINOIS, INDIANA, MICHIGAN, OHIO, WISCONSIN

More lime is produced in the Northeast Central States than in any other group. Ohio is the largest producer followed by Wisconsin, Indiana, Illinois, and Michigan in the order named. Ohio is also the largest producer in the United States, producing in 1924 one and one-third times as much as Pennsylvania, the second State.

The important lime plants in Illinois are in the vicinity of Chicago (high-magnesium lime) and in the southwestern part of the State (high-calcium lime) near the Mississippi River. The product is about evenly divided between chemical and building lime. In 1924 nearly two-thirds of the product was consumed within the State, and besides shipments to Indiana, Iowa, Minnesota, Missouri, and Wisconsin, there were small shipments to 12 other States, both in the East and the West. The total lime supply in Illinois was four times the total production. Wisconsin shipped 69 per cent of its total output of lime to Illinois, and shipments of importance were also made to Illinois from Indiana, Missouri, and Ohio, with small amounts from several other States.

The lime-producing districts in Indiana are confined to the northeastern and south-central parts of the State. The product is mainly chemical lime, but considerable is sold for building, and a small amount for agriculture. In 1924 somewhat less than half the product was consumed within the State. The largest shipments were to Illinois, Kentucky, Michigan, and Ohio, with smaller amounts to 14 other States.

The production of lime in Michigan is confined to the northern part of the lower peninsula and the southern part of the upper peninsula, all plants being on or near lake shores. About 83 per cent of the product in 1924 was chemical lime and practically all the remainder was building lime. Over half of the total quantity sold was consumed in the State in 1924. The shipments were chiefly to Wisconsin. The principal States furnishing lime to Michigan were Indiana and Ohio, but shipments were also received from Illinois, Minnesota, Missouri, New York, Pennsylvania, Virginia, West Virginia, and Wisconsin.

Ohio showed larger sales of building lime than any other State, and in 1924 furnished 31 per cent of the total lime sold for this purpose. In chemical lime Ohio ranked second, being exceeded by Pennsylvania, but supplying 15 per cent of the total chemical lime sold. Among the large producers of agricultural lime, Ohio ranks after Pennsylvania and Maryland. Ohio also produces most of the hydrated lime sold in the United States. The sales of hydrated lime in 1924 amounted to 50 per cent of the total quantity sold. The greater part of the hydrated lime sold for construction in Ohio is a high-grade finishing lime.

The total sales in Ohio of all grades of quick and hydrated limes for construction in 1923 and 1924 were as follows:

Lime sold by Ohio producers for construction, 1923–24

	1923		1924	
	Short tons	Value	Short tons	Value
Quicklime	33, 374	$281, 029	33, 675	$282, 171
Hydrated lime	580, 999	5, 832, 040	637, 835	6, 609, 598
	614, 373	6, 113, 069	671, 510	6, 891, 769

Of the agricultural lime sold in Ohio in 1924, 76 per cent was hydrated lime, but the quantity of hydrated lime sold for chemical use was very small. The lime produced in Ohio is widely distributed; 71 per cent of the lime manufactured and sold was shipped from the State in 1924. The largest shipments were to New York, Michigan, Pennsylvania, Illinois, New Jersey, Indiana, and West Virginia, in the order named. Lime was also reported shipped from Ohio to 33 other States and several foreign countries. Ohio received shipments of lime from several States, the largest shipments being from Indiana and Pennsylvania.

The lime manufactured in Wisconsin is high-magnesium lime, and the manufacturing plants are all in the southeastern part of the State. Of the total quantity sold in 1924, 97 per cent was lime for construction. Most of the lime sold is shipped to Illinois—69 per cent of the total sales in 1924. Twenty-four per cent was consumed in the State, and the remainder was shipped in comparatively small quantities to 12 other States and to Canada.

The lime-manufacturing plants in the Northeast Central States are as follows:

ILLINOIS

Adams County:

Marblehead—Marblehead Lime Co. (address, Chicago); high-calcium; 3 flame kilns, 5 gas kilns; 75 tons a day; producer gas, coal, and wood; quicklime (lump), construction, agriculture, chemical; hydrated, mason's, chemical; Kritzer hydrator; tunnel and open quarry.

Quincy—Black White Lime Co.; high-calcium; 5 patent kilns; 50 tons a day; bituminous coal; quicklime, construction, chemical; tunnel quarry.

——— Marblehead Lime Co. (address, Chicago); high-calcium; 4 flame kilns; 40 tons a day; coal and wood; quicklime (lump), construction, agriculture, chemical; hydrated, mason's, chemical; Kritzer hydrator; tunnel and open quarry.

——— F. W. Menke Stone & Lime Co.; high-calcium; 3 flame kilns; 37½ tons a day; bituminous coal; quicklime (lump), construction, chemical; tunnel and open quarry.

Cook County:

Chicago—Chicago Union Lime Works Co.; high-magnesium; 5 field kilns; 52½ tons a day; shavings and manure; quicklime (lump), construction; open quarry.

——— Stearns Lime & Stone Co.; high-magnesium; 6 pot kilns; 60 tons a day; shavings and manure; quicklime (lump), construction.

Riverside—Riverside Lime & Stone Co. (address, Chicago); high-magnesium; 4 patent kilns; 40 tons a day; quicklime (lump), construction; open quarry.

Kankakee County: Kankakee—C. V. Ruhle; 1 pot kiln; wood; quicklime, construction.

Madison County: Alton—Mississippi Lime & Material Co.; high-calcium; 3 patent kilns, 1 gas kiln; bituminous coal, producer gas; 60 tons a day; quicklime (lump), construction, chemical.

Rock Island County: Port Byron—Port Byron Lime Association; high-magnesium; 3 field kilns; 35 tons a day; bituminous coal; hydrated, mason's; Clyde hydrator; open quarry.

Will County: Joliet—Estate of Thos. H. Patterson; small plant. Idle 1924.

INDIANA

Cass County: Logansport—The Logansport Stone & Lime Co. (address, Huntington); high-calcium, high-magnesium; 6 patent kilns; 45 tons a day; bituminous coal; quicklime (lump, ground to 10 mesh), construction, chemical; hydrated, mason's, agriculture, chemical; Clyde hydrator.

Harrison County: Milltown—Louisville Cement Co. (address, Louisville, Ky.); low-magnesium, high-calcium; 3 flame kilns, 2 gas kilns, 1 rotary kiln; 125 tons a day; bituminous coal, producer gas; quicklime (lump, pebble), construction, chemical, agriculture; hydrated, mason's, chemical, agriculture; Clyde hydrator; tunnel and open quarry.

Huntington County: Huntington—Kelley Island Lime & Transport Co. (address, Cleveland, Ohio); high-magnesium; 18 patent kilns; 144 tons a day; bituminous coal; quicklime (lump, ground), construction, agriculture, chemical; hydrated, mason's, finishing, agriculture; Kritzer hydrator; open quarry.

Lawrence County:

Bedford—Indiana Quarries Co. (address, Chicago, Ill.); high-calcium; 7 pot kilns; 60 tons a day; bituminous coal; quicklime (lump), construction, chemical.

Mitchell—Lehigh Lime Co. (address, Allentown, Pa.); high-calcium; 24 patent kilns; 300 tons a day; bituminous coal; quicklime (lump), agriculture, construction, chemical; hydrated, mason's, chemical, agriculture; Kelleher hydrator; open quarry.

Putnam County: Putnamville—Indiana State Farm; lime burned for use on State farm; brick kiln with brick and hollow ware; quicklime (lump), construction.

Washington County: Salem—Hoosier Lime Co.; high-calcium; 5 flame kilns; 60 tons a day; bituminous coal; quicklime, construction, chemical; open quarry.

MICHIGAN

Charlevoix County: Bayshore—Northern Lime & Stone Co. (address, Petoskey); high-calcium, high-magnesium, low-magnesium; 4 flame kilns; 40 tons a day; wood; quicklime (lump), construction, agriculture; hydrated, mason's, chemical, agriculture; open quarry.

Cheboygan County: Afton—Campbell Stone Co. (address, Indian River); high-calcium; 1 rotary kiln; 50 tons a day; bituminous coal; quicklime (lump), chemical; open quarry.

Chippewa County: Sault Ste. Marie—Union Carbide Co. (address, New York, N. Y.); high-calcium; 12 gas kilns, 3 rotary kilns; 282 tons a day; pulverized bituminous coal; quicklime, chemical; open quarry. This company purchases the stone burned from Michigan Limestone & Chemical Co., Rogers, and most of the material made is used in the manufacture of calcium carbide.

Emmet County:

Petoskey—Antrim Lime Co. (address, Grand Rapids); low-magnesium; 3 field kilns; 23 tons a day; wood; quicklime, chemical; open quarry.

——— Northern Lime & Stone Co.; high-calcium, low-magnesium, high-magnesium; 5 flame kilns; 40 tons a day; wood; quicklime (lump), construction, chemical; open quarry.

Menominee County: Menominee—Limestone Products Co.; high-calcium; 11 patent kilns; 132 tons a day; bituminous coal; quicklime (lump), construction, chemical; installing a Kritzer hydrator. This company buys the stone used in making lime from Michigan Limestone & Chemical Co., Rogers.

Schoolcraft County:

Blaney and Manistique—Manistique Lime & Stone Co.; high-calcium, high-magnesium; 6 flame kilns; 10 tons a day; producer gas, wood; quicklime (lump), construction, chemical; hydrated, mason's, chemical; Clyde hydrator; open quarry.

Marblehead—Manistique Lime & Stone Co.; high-magnesium; 2 pot kilns; 17 tons a day; wood; quicklime (lump), construction, chemical; open quarry.

OHIO

Adams County: Peebles—Basic Products Co. (address, Pittsburgh, Pa.); high-magnesium; 6 rotary kilns; 480 tons a day; bituminous coal; quicklime (granular, ground to 30 mesh), dead-burned dolomite, chemical; hydrated, mason's, finishing, agriculture; open quarry. The kilns are at Kenova, West Virginia, and the quarry is at Peebles.

Clark County:

Springfield—J. W. Jenkins; high-magnesium; 3 gas kilns; 25 tons a day; natural gas; quicklime (lump), construction, chemical; open quarry.

——— Moores Lime Co.; high-magnesium; 8 gas kilns; natural gas, producer gas; quicklime (ground to 10 mesh, granular, lump, pebble), construction, agriculture, dead-burned dolomite, chemical; hydrated, mason's, chemical, agriculture; Kritzer hydrator; open quarry.

——— National Mortar & Supply Co. (address, Pittsburgh, Pa.); high-magnesium; 10 flame kilns; 100 tons a day; bituminous coal; quicklime (lump, ground to 16 mesh), construction, agriculture, chemical; hydrated, mason's, agriculture; Lauman hydrator.

Delaware County:

Delaware—The Scioto Lime & Stone Co.; low-magnesium; 12 flame kilns; 108 tons a day; bituminous coal; quicklime (lump, pebble), construction, chemical; hydrated, mason's, chemical, agriculture; hydrator, owner's patent; open quarry.

White Sulphur—American Hydrated Lime Co. (address, Cleveland); high-magnesium, low magnesium; 6 pot kilns; 50 tons a day; bituminous coal; hydrated, construction, agriculture; Clyde hydrator.

Erie County: Sandusky—Kelley Island Lime & Transport Co. (address, Cleveland); high-calcium; 10 flame kilns; 80 tons a day; bituminous coal; quicklime (lump), construction, chemical. The quarry for this plant is on Kelley Island. Kilns closed indefinitely in 1924.

Franklin County: Columbus—Marble Cliff Quarries Co.; low-magnesium; 1 rotary kiln; 80 tons a day; producer gas; quicklime (pebble), construction, chemical; hydrated, mason's, chemical, agriculture; Schaffer hydrator; new plant, started March, 1924.

Greene County: Cedarville—Abel Magnesia Co.; high-magnesium; 3 flame kilns; bituminous coal; quicklime (lump), chemical; hydrated, mason's; Clyde hydrator; open quarry.

Hardin County: Forest—John Herzog & Son; high-magnesium; 6 shaft kilns; 36 tons a day; bituminous coal; quicklime (ground to 20 mesh), chemical; hydrated, mason's, finishing; batch hydrator; open quarry.

Marion County:

Marion—John Evans Lime & Stone Co.; low-magnesium; 10 flame kilns; 80 tons a day; bituminous coal; quicklime (lump), construction, chemical; hydrated, mason's; Clyde hydrator; open quarry.

——— Kelley Island Lime & Transport Co. (address, Cleveland); low-magnesium; 18 flame kilns; 144 tons a day; bituminous coal; quicklime (lump), construction, chemical; hydrated, mason's, agriculture, chemical; Clyde and Lauman hydrators.

Owens—John D. Owens & Co.; high-calcium; 10 flame kilns; 50 tons a day; producer gas; quicklime (lump), construction, chemical; hydrated, mason's, chemical, agriculture.

Ottawa County:

Clay Center—Kelley Island Lime & Transport Co. (address, Cleveland); high-magnesium; 53 flame kilns, 1 rotary kiln; 524 tons a day; bituminous coal, producer gas; quicklime (lump, ground), agriculture, chemical; hydrated, finishing, agriculture; Clyde hydrator.

Genoa—United States Gypsum Co. (address, Chicago, Ill.); high-magnesium; 40 flame kilns; 450 tons a day; bituminous coal; hydrated, mason's, finishing; Schaffer hydrator; open quarry.

Limestone—Benton Lime & Stone Co. (address, Oak Harbor); high-magnesium; 2 pot kilns; 20 tons a day; bituminous coal; quicklime (ground to ¼ inch), chemical; open quarry; new plant in 1924.

Marblehead—Kelley Island Lime & Transport Co. (address, Cleveland); low-magnesium, high-calcium; 25 flame kilns; 200 tons a day; bituminous coal; quicklime (lump, ground), construction, chemical, agriculture; hydrated, mason's, agriculture, chemical; Clyde and Carson hydrators; open quarry.

Sandusky County:

Gibsonburg—Kelley Island Lime & Transport Co. (address, Cleveland); high-magnesium; 22 flame kilns; 176 tons a day; bituminous coal; quicklime (lump, ground), chemical; hydrated, finishing; Lauman hydrator.

———National Mortar & Supply Co. (address, Pittsburgh, Pa.); high-magnesium; 35 flame kilns; 420 tons a day; producer gas; quicklime (lump, ground to 16 mesh), agriculture, chemical; hydrated, mason's, finishing, agriculture; Lauman hydrator; open quarry.

———Wm. L. Urschel Lime & Stone Co. New plant; operated part of 1924.

Woodville—Bruns Hydrated Lime Co.; new plant; under construction in 1924.

———The Ohio Hydrate & Supply Co.; high-magnesium; 24 flame kilns; 400 tons a day; bituminous coal; quicklime (lump, ground to 10 mesh), agriculture, construction, chemical; hydrated, mason's, finishing, agriculture; Schaffer hydrator; open quarry.

———Washington Building Lime Co. (address, Baltimore, Md.); high-magnesium; 32 flame kilns; 400 tons a day; bituminous coal; hydrated, finishing; batch hydrator; open quarry.

———Woodville Lime Products Co. (address, Toledo); high-magnesium; 41 flame kilns; 500 tons a day; bituminous coal; hydrated, finishing, agriculture; open quarry.

Seneca County:

Bettsville—Kennedy Refractories Co. (address, Tiffin); high-magnesium; 2 rotary kilns; 150 tons a day; bituminous coal; quicklime, dead-burned dolomite ("Kendymag"); open quarry.

Maple Grove—The Dolomite Products Co.; high-magnesium; 2 rotary kilns; 200 tons a day; bituminous coal; quicklime, dead-burned dolomite.

Tiffin—Consumers Lime Co. (address, Fairmont, W. Va.); 2 flame kilns; 15 tons a day; bituminous coal; quicklime (lump, ground), agriculture, chemical; open quarry.

———Kelley Island Lime & Transport Co. (address, Cleveland); high-magnesium; 5 flame kilns; 30 tons a day; quicklime (ground), chemical; open quarry.

Stark County:

Bolivar—W. C. Allman; 1 draw kiln; coal; agriculture.

Canton—Stark Grey Lime Co.; high-magnesium; 4 pot kilns; 18 tons a day; coal; agriculture; open quarry.

Louisville—Louisville Lime Co.; high-calcium; 1 pot kiln; 3 tons a day; quicklime, agriculture.

Tuscarawas County: Zoar—Zoar Agricultural Lime Co.; agriculture.

Wood County: Luckey—Luckey Lime & Supply Co.; high-magnesium; 6 flame kilns; 100 tons a day; bituminous coal; hydrated, mason's, finishing, agriculture; Clyde hydrator; open quarry.

Wyandotte County: Carey—National Lime & Stone Co.; high-magnesium; 14 flame kilns; 168 tons a day; bituminous coal; quicklime (lump, granular, ground), agriculture, chemical; hydrated, mason's, finishing, chemical, agriculture; Clyde continuous hydrator.

WISCONSIN

Calumet County:

Brillion—Western Lime & Cement Co. (address, Milwaukee); high-magnesium; 9 flame kilns; 104 tons a day; wood; quicklime, construction; hydrated, construction.

Hayton—Western Lime & Cement Co. (address, Milwaukee); high-magnesium; 4 patent kilns; 47 tons a day; wood; quicklime, construction.

High Cliff—Western Lime & Cement Co. (address, Milwaukee); high-magnesium; 3 flame kilns; 36 tons a day; wood; quicklime, construction; hydrated, construction.

Dodge County:

Knowles—Western Lime & Cement Co. (address, Milwaukee); high-magnesium; 2 flame kilns; 20 tons a day; wood; quicklime, construction.

Knowles (Nasbro)—Standard Lime & Stone Co. (address, Fond du Lac); high-magnesium; 4 flame kilns; 50 tons a day; wood; quicklime, construction; hydrated, mason's; Kritzer continuous hydrator; open quarry.

Dodge County—Continued.

Knowles (Nasbro)—Western Lime & Cement Co. (address, Milwaukee); high-magnesium; 5 flame kilns; 65 tons a day; wood; quicklime, construction; hydrated, construction.

Mayville—Mayville White Lime Works; high-magnesium; 3 flame kilns; 45 tons a day; wood; quicklime (lump), construction; open quarry.

Door County: Small plants for local supply, chiefly construction.

Fond du Lac County:

Eden—Western Lime & Cement Co. (address, Milwaukee) (Marblehead plant); high-magnesium; 10 flame kilns; 120 tons a day; wood; quicklime, construction; hydrated, construction.

Fond du Lac—Western Lime & Cement Co. (address, Milwaukee) (Hamilton plant); high-magnesium; 5 flame kilns; 60 tons a day; wood; quicklime, construction.

Manitowoc County:

Grimms—Western Lime & Cement Co. (address, Milwaukee); high-magnesium; 8 flame kilns; 96 tons a day; wood; quicklime, construction.

Manitowoc—Allwood Lime Co.; high-magnesium; 4 flame kilns; 50 tons a day; wood; quicklime, construction, chemical; hydrated, construction.

——— Rockwell Lime Co. (address, Chicago, Ill.); high-magnesium; 4 pot kilns; 45 tons a day; wood; quicklime (lump, ground), construction.

Valders—Standard Lime & Stone Co. (address, Fond du Lac); high-magnesium; 5 flame kilns; 65 tons a day; wood; quicklime, construction.

——— Valders Lime & Stone Co.; high-magnesium; 5 flame kilns; 50 tons a day; wood; quicklime, construction, chemical; open quarry.

——— Western Lime & Cement Co. (address, Milwaukee) (Quarry plant); high-magnesium; 3 flame kilns; 36 tons a day; wood; quicklime, construction.

Ozaukee County:

Cedarburg—John F. Groth & Son; high-magnesium; 3 flame kilns; 40 tons a day; wood; quicklime (lump), construction, agriculture; open quarry.

Grafton—Milwaukee Falls Lime Co.; high-magnesium; 5 flame kilns; 60 tons a day; wood; quicklime (lump), construction; open quarry.

Shawano County: Bonduel—Wussow Lime Kiln Co.; 1 pot kiln; wood; quicklime, construction.

Sheboygan County:

Elkhart Lake—Garden City Land & Lime Co.; high-magnesium; 4 pot kilns; 50 tons a day; wood; quicklime (lump), construction; plant taken over by Valders Lime & Stone Co. in September, 1924.

Sheboygan—Sheboygan Lime Works; high-magnesium; 4 flame kilns; 45 tons a day; wood; quicklime (lump), construction, chemical; open quarry.

Sheboygan Falls—Falls Lime & Stone Co.; high-magnesium; 1 flame kiln; 10 tons a day; wood; quicklime (lump), construction.

Washington County:

Fredonia—Emil Peterson; small plant; construction.

Rockfield—Rockfield Products Co.; high-magnesium; 2 pot kilns; 24 tons a day; wood; quicklime, construction.

SOUTHEAST CENTRAL STATES

ALABAMA, KENTUCKY, TENNESSEE

Alabama is the largest producer of the Southeast Central States. In 1924, 27 per cent of its product was constructional lime and 73 per cent chemical lime. The State produces both high-calcium and magnesian lime, and the chief plants are in the vicinity of Birmingham. The greater part of the lime manufactured was consumed in the State, but lime was shipped in considerable quantities to Florida, Georgia, Louisiana, and Mississippi, with smaller amounts to North Carolina, South Carolina, and Tennessee. In 1924 the total consumption in the State was less than the production.

The output of Kentucky is chiefly consumed within the State, although some lime was shipped to Ohio and Tennessee in 1924.

Kentucky consumed nearly four times as much lime as it manufactured. The shipments into the State were chiefly from Indiana, Ohio, and Tennessee.

The lime manufactured in Tennessee is used about equally for construction and chemicals, with a small amount for agriculture. The plants, which are in the eastern, central, and northern parts of the State, shipped 73 per cent of their output from the State in 1924. The largest shipments were to Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Ohio, South Carolina, and Virginia. The lime manufactured near Knoxville is largely from the waste of the marble quarries.

The lime-manufacturing plants in the Southeast Central States are as follows:

ALABAMA

Blount County: Allgood—Cheney Lime Co.; high-calcium; 8 patent kilns; 120 tons a day; coal and wood; quicklime (lump), construction, chemical; hydrated, mason's; open quarry.

De Kalb County:

Fort Payne—Alabama Lime Works; high-calcium; 2 pot kilns; 12 tons a day; bituminous coal; construction. Idle 1924.

——— Buckels Lime Works; construction, chemical; small plant for local supply.

Jackson County: Bridgeport—Alabama-Tennessee Lime Co. (address, Chattanooga, Tenn.); high-calcium; 3 pot kilns; 25 tons a day; wood, bituminous coal; construction. Idle 1924.

Jefferson County: Ensley—Tennessee Coal, Iron & Railroad Co. (address, Birmingham); high-magnesium; manufacture of steel; dead-burned dolomite.

Shelby County:

Calera and Eureka—Alabama Lime & Stone Corporation (address, Birmingham); high-calcium; 3 upright brick kilns; 35 tons a day; bituminous coal and wood; quicklime, construction, chemical; hydrated, construction; own type of hydrator; open quarry. Modern plant to be erected at Calera in 1925.

Keystone—Keystone Lime Works; high-calcium; 8 flame kilns; 30 tons a day; bituminous coal, coal and wood; quicklime (lump), construction; hydrated, mason's, chemical; Clyde hydrator; open quarry.

Longview—Longview Lime Works; high-calcium; 6 patent kilns; 75 tons a day; bituminous coal, coal and wood; quicklime (lump), construction, chemical; hydrated, mason's, finishing, chemical; Clyde hydrator; open quarry.

Newala—Newala Lime Works; high-calcium; 2 patent kilns; 20 tons a day; wood and bituminous coal; quicklime (lump), construction, agriculture; hydrated, mason's, finishing; batch hydrator; open quarry.

Pelham—Superior Lime & Hydrate Co.; high-calcium; 4 shaft kilns; 50 tons a day; bituminous coal and wood; quicklime (lump), construction, chemical; hydrated, mason's, chemical; open quarry.

Roberta—Calera Lime Works (address, Calera); high-calcium; 2 vertical kilns; 25 tons a day; bituminous coal and wood; quicklime (lump), construction; open quarry.

Saginaw—Saginaw Lime & Stone Co. (address, Longview); high-calcium; 4 flame kilns; 45 tons a day; bituminous coal and wood; quicklime (lump), construction, chemical; hydrated, mason's, finishing, chemical, agriculture; Clyde hydrator; open quarry.

KENTUCKY

Meade County: Battletown—Small plants for local supply.

Rockcastle County:

Mount Vernon—Mount Vernon Lime Co.; construction; wood.

Pine Hill—Rockcastle Cement & Lime Co. (address, Mount Vernon); high-calcium; 5 patent kilns; 50 tons a day; bituminous coal and wood; quicklime (lump), construction, agriculture, chemical; hydrated. mason's, chemical, agriculture; Clyde hydrator; stone mined.

TENNESSEE

Coffee County: Summitville—Tennessee Cement & Lime Co. (address, Nashville); high-calcium; 6 flame kilns; 60 tons a day; wood or wood and coal; quicklime (lump, pebble), construction, chemical, agriculture; hydrated, mason's, agriculture; rotary hydrator; open quarry.

Cumberland County: Crab Orchard—Southern States Lime Corporation (address, Charleston, S. C.); high-calcium; 6 pot kilns; 60 tons a day; bituminous coal; quicklime (lump), construction; hydrated, mason's; open quarry.

Dickson County: Burns—Jesse Allen Lime Co.; high-calcium; 5 pot kilns; 45 tons a day; anthracite and wood; quicklime (lump, ground to ¾ to 1½ in.), construction, chemical; hydrated, mason's, chemical; open quarry.

Franklin County:

Sherwood—Gager Lime & Manufacturing Co. (address, Chattanooga); high-calcium; 16 flame or patent kilns; 225 tons a day; bituminous coal; quicklime, construction, chemical; hydrated, mason's, agriculture, chemical; Schaffer hydrator.

——— Robinson Lime Co. New company, organized in 1924.

Hamilton County: Ooltewah—Southern Junior College; construction; small plant for local supply.

Houston County:

Erin: Eureka Lime Works; 1 flame kiln; 7½ tons a day; quicklime (lump), construction.

—— Rauscher Lime Co. (Inc.); high-calcium; 9 flame kilns; 85 tons a day; bituminous coal and wood; quicklime (lump), construction; tunnel and open quarry.

Knox County:

Concord—Concord Lime Co.; high-calcium; 1 flame or patent kiln; 6 tons a day; anthracite; quicklime (lump), agriculture, construction, chemical; open quarry.

Knoxville—Champion Fibre Co. (address, Canton, N. C.); high-calcium; 4 pot kilns; 80 tons a day; bituminous coal and coke; quicklime (lump), chemical; open quarry.

——— Oliver King Sand & Lime Co.; high-calcium; 8 flame kilns; 70 tons a day; bituminous coal; quicklime (lump), construction, chemical; hydrated, mason's, chemical; Schaffer hydrator; open quarry.

——— Knoxville Sand & Lime Co.; high-calcium; 5 flame kilns; 45 tons a day; btiuminous coal; quicklime (lump, ground), construction, agriculture, chemical; hydrated, mason's, chemical; Clyde hydrator; open quarry.

——— Marble City Lime Co.; high-calcium; 2 pot kilns; 15 tons a day; bituminous coal; quicklime (lump), agriculture, chemical; open quarry.

——— Tennessee Marble Lime Co.; high-calcium; 6 vertical kilns; 60 tons a day; bituminous coal; quicklime (lump), agriculture, chemical; open quarry.

——— Williams Lime Manufacturing Co.; high-calcium; 6 shaft kilns; 75 tons a day; bituminous coal; quicklime (lump), construction, agriculture, chemical; hydrated, mason's, chemical; Schaffer continuous hydrator; open quarry.

Montgomery County: Palmyra—Palmyra Lime Co.; high-calcium, low-magnesium; 2 flame kilns; 20 tons a day; bituminous coal and wood; quicklime (lump), construction, chemical; open quarry.

Rhea County: Washington—Washington White Lime Co. (address, R. D., Dayton); construction; small plant for local supply.

Robertson County: Adams—Warren Lime Manufacturing Co.; high-calcium; 2 flame kilns; 15 tons a day; bituminous coal and wood; quicklime (lump), construction; hydrated, mason's; batch hydrator.

NORTHWEST CENTRAL STATES

IOWA, MINNESOTA, MISSOURI, SOUTH DAKOTA

Missouri, in the Northwest Central States, ranked as the third largest lime producer in the United States in 1924, being exceeded by Ohio and Pennsylvania. Missouri also ranks third in the sales of hydrated lime, and shows a wider range of shipments of this product than any other State except Ohio. About two-thirds of the lime manufactured in Missouri in 1924 was chemical lime, the remainder, except for a small amount sold for agriculture, was sold for construction. The lime plants are in the eastern part of the State, near the Mississippi River, and in the southwestern part of the State. The largest shipments of lime from Missouri in 1924 were to Illinois, Iowa, and Kansas, but shipments were made to California and Washington in the West, to all the South and North Central States, and to New York and several other Atlantic States. In return Arkansas, Illinois, Indiana, New York, Ohio, Pennsylvania, Tennessee, and Wisconsin shipped lime to Missouri. In 1924 the total consumption in the State was less than half of the total sales.

Only a small amount of lime is manufactured in Iowa, the market being supplied chiefly from Ohio, but also from Arkansas, Illinois, Indiana, Minnesota, Tennessee, and Wisconsin.

The lime manufactured in Minnesota is chiefly sold for construction and is consumed within the State, although in 1924 small quantities were shipped to Iowa, Michigan, Nebraska, North Dakota, South Dakota, Wisconsin, and Canada. Minnesota received lime from Illinois, Indiana, Missouri, Ohio, and Wisconsin. In 1924 the consumption of lime in the State was more than the sales.

The lime manufactured in South Dakota is all used locally, and the general markets were supplied in 1924 from Colorado, Illinois, Indiana, Minnesota, Missouri, Ohio, and Wisconsin.

The plants that manufacture lime in the Northwest Central States are as follows:

IOWA

Dubuque County: Dubuque—Eagle Point Lime Works; high-magnesium; 2 pot kilns; 18 tons a day; wood; quicklime (lump), construction; open quarry.

Jackson County: Maquoketa—A. A. Hurst; high-magnesium; 4 patent kilns; 60 tons a day; bituminous coal, wood; quicklime (lump), construction; open quarry.

MINNESOTA

Blue Earth County:
  Mankato—T. R. Coughlan Co.; high-magnesium; 1 flame kiln; 10 tons a day; wood; quicklime (lump), construction; open quarry.
  ——— Fowler & Pay: low-magnesium; 7 patent kilns; 56 tons a day; bituminous coal; quicklime (lump), construction; open quarry.

Goodhue County:
  Red Wing—Gust. Lillyblad; 1 pot kiln; 15 tons a day. Idle 1924.
  ——— Mankato Lime Co. Plant under construction in 1924.

Mower County: Leroy—Fowler & Pay (address, Mankato); high-calcium; 2 patent kilns; 16 tons a day; bituminous coal; quicklime (lump), construction, chemical; open quarry.

St. Louis County: Duluth—Cutler-Magner Co.; 13 pot kilns; 60 tons a day; wood; quicklime (lump), construction, chemical; hydrated, mason's, finishing, chemical; Clyde hydrator. Stone from which lime is made is from quarries of the Kelley Island Lime & Transport Co., Cleveland, Ohio.

MISSOURI

Franklin County: Washington—Washington Lime Kiln Co.; construction; small plant for local supply.

Greene County:

Ash Grove—Ash Grove Lime & Portland Cement Co. (address, Kansas City); high-calcium; 10 flame kilns; 120 tons a day; wood; quicklime (lump, granular), construction, chemical; hydrated, mason's, finishing, chemical; Clyde hydrator; open quarry.

Galloway—Ash Grove Lime & Portland Cement Co. (address, Kansas City); high-calcium; 4 flame kilns; 110 tons a day; bituminous coal; quicklime (lump, granular, ground to 30 mesh), construction, chemical; hydrated, mason's, finishing, chemical; Schaffer hydrator; open quarry.

Springfield—Marblehead Lime Co. (address, Chicago, Ill.); high-calcium; 9 flame kilns; 90 tons a day; wood; quicklime (lump), construction, chemical; hydrated, mason's, chemical; Kritzer hydrator; tunnel and open quarry.

Jefferson County:

Byers (P. O., Kimmswick)—Glencoe Lime & Cement Co. (address, St. Louis); high-calcium; 5 gas kilns; 40 tons a day; producer gas; quicklime (lump), construction, chemical. Idle 1924.

Glen Park (P. O., Sulphur Springs)—Glencoe Lime & Cement Co. (address, St. Louis); high-calcium; 2 gas kilns; 45 tons a day; producer gas; quicklime, construction, chemical.

Lawrence County: Pierce City—Pierce City Lime Co.; high-calcium; 3 flame kilns; 30 tons a day; wood; quicklime (lump), construction; open quarry.

Marion County: Hannibal (near)—Marblehead Lime Co. (address, Chicago, Ill.); high-calcium; 5 flame kilns; 50 tons a day; oil, coal and wood; quicklime (lump), construction, chemical; hydrated, mason's, chemical; Kritzer hydrator; tunnel and open quarry.

Pike County: Louisiana—Marblehead Lime Co. (address, Chicago, Ill.); high-calcium; 4 flame kilns; 40 tons a day; coal and wood; quicklime (lump), construction, chemical; hydrated, mason's, chemical; Kritzer hydrator; tunnel and open quarry.

Ralls County: Hannibal—Bluff City Lime & Stone Co. (address, Alton, Ill.); high-calcium; 3 flame kilns; 40 tons a day; bituminous coal; quicklime (lump, pebble, granular), construction, chemical, agriculture; hydrated, mason's, chemical, agriculture; Kritzer hydrator; tunnel quarry.

St. Clair County: Osceola—Osceola Lime Co.; high-calcium; 2 flame kilns; 17 tons a day; wood; quicklime (lump), chemical; installing continuous hydrator; open quarry.

Ste. Genevieve County:

Brickeys—Arrowhead Manufacturing Co. (address, St. Louis); high-calcium; 4 flame kilns; 36 tons a day; bituminous coal; quicklime (lump), construction, chemical; tunnel quarry.

Ste. Genevieve—Bluff City Lime & Stone Co. (address, Alton, Ill.); plant under construction.

——— Peerless White Lime Co. (address, St. Louis); high-calcium; 1 flame kiln, 7 gas kilns; 160 tons a day; bituminous coal, producer gas; quicklime (lump), construction, chemical; hydrated, mason's, chemical; Kritzer continuous hydrator; tunnel quarry.

——— Ste. Genevieve Lime & Quarry Co. (address, St. Louis); high-calcium; 2 flame kilns, 4 gas kilns; 120 tons a day; bituminous coal, producer gas; quicklime (lump), construction, chemical; hydrated, mason's, chemical; Clyde hydrator; tunnel and open quarry.

——— Western Lime Works; high-calcium; 4 flame kilns, 2 gas kilns; 100 tons a day; bituminous coal, producer gas; quicklime (lump), construction, chemical; open quarry.

St. Louis County:

Centaur Station—Centaur Lime Co.; high-calcium; 2 flame kilns; 25 tons a day; coal and wood; quicklime, construction, chemical; open quarry.

Glencoe—Glencoe Lime & Cement Co. (address, St. Louis); high-calcium; 9 flame kilns; 85 tons a day; bituminous coal; quicklime (lump), construction, agriculture, chemical; tunnel and open quarry.

Mincke (P. O., Eureka)—Glencoe Lime & Cement Co. (address, St. Louis); high-calcium; 5 flame kilns; 50 tons a day; bituminous coal; quicklime (lump), construction, chemical; hydrated, mason's, agriculture, chemical; Kritzer hydrator; tunnel quarry.

SOUTH DAKOTA

Lawrence County: Spearfish—H. H. Lewis; construction; small plant for local supply.

Meade County: Calcite—Homestead Mining Co. (address, Lead); high-calcium; 2 flame kilns; 25 tons a day; wood; quicklime (lump), chemical; open quarry; product all used in works of company.

SOUTHWEST CENTRAL STATES

ARKANSAS, OKLAHOMA, TEXAS

The lime produced in the Southwest Central States is from widely separated areas. In Arkansas production is confined to the northern part of the State, and the lime is sold chiefly for construction. In 1924 over one-half of the output was shipped from the State, chiefly to Louisiana, although some was sent to Iowa, Kansas, Mississippi, Missouri, Nebraska, Oklahoma, and Tennessee. The plant in operation in Oklahoma is in the southeastern part of the State. Texas is the largest lime producer of these States. Except for a plant in the extreme west-central part of the State (El Paso County), lime is made along a northeast and southwest belt east of the central part of the State. About 73 per cent of the output was reported as used for construction in 1924; the remainder was chemical lime except a small amount for agriculture. About one-half of the lime sold for construction was hydrated lime. Over 77 per cent of the production was shipped to points within the State. The outside shipments were chiefly to Louisiana, with small amounts to Arizona, Arkansas, Colorado, New Mexico, Oklahoma, Porto Rico, and Mexico. The shipments of lime into the State were small and were from Missouri, New Mexico, and Ohio. The consumption was much less than the production.

The lime-manufacturing plants in the Southwest Central States are as follows:

ARKANSAS

Baxter County: Gassville—Jas. T. Langham; small plant.

Izard County:

- Limedale—Batesville White Lime Co. (address, Batesville); high-calcium; 3 patent kilns; wood; Kritzer continuous 6-cylinder hydrator; open quarry. New plant in 1924.
- Ruddells—Batesville White Lime Co. (address, Batesville); high-calcium; 3 patent kilns; 40 tons a day; quicklime (lump), construction, chemical; open quarry.

Searcy County: St. Joe—Moss-DeVoy Lime & Stone Co. (address, Memphis, Tenn.); high-calcium; 1 pot kiln; 10 tons a day; wood; quicklime, construction, chemical; open quarry.

Washington County: Johnson—Ozark White Lime Co. (address, Fayetteville); high-calcium; 6 flame kilns; 60 tons a day; wood; quicklime (lump), construction, agriculture, chemical; hydrated, mason's, finishing, chemical, agriculture; tunnel quarry.

OKLAHOMA

Adair County: Watts—Southern White Lime Co. (address, Pierce City, Mo.); high-calcium; 1 flame kiln; 12 tons a day; wood; quicklime (lump), construction; open quarry.

TEXAS

Comal County: New Braunfels—Dittlinger Lime Co.; high-calcium; 5 patent kilns; 80 tons a day; oil; quicklime (lump, ground to 1½ inch), construction, agriculture; hydrated, mason's, chemical, agriculture; Kritzer hydrator; open quarry.

Coryell County: Oglesby—D. R. Boone; construction; small plant.

Dallas County: Dallas—Michel Lime Co.; low-magnesium; 2 flame kilns; 20 tons a day; oil; construction. Idle 1924.

El Paso County: El Paso—El Paso Building Material Co.; low-magnesium; 6 pot kilns; 60 tons a day; anthracite; quicklime (lump), construction, chemical; open quarry.

Tarrant County: Fort Worth—Southwestern Lime Co.; low-magnesium; 1 pot kiln; 5 tons a day; wood; quicklime (lump), agriculture.

Travis County: McNeill—Austin White Lime Co. (address, Austin); high-calcium; 8 patent kilns; 100 tons a day; lignite; quicklime (lump), construction, chemical; hydrated, mason's, finishing, chemical; Kritzer continuous hydrator; open quarry.

Williamson County: Round Rock—Round Rock White Lime Co.; high-calcium; 6 patent kilns; 60 tons a day; lignite; quicklime (lump), construction, chemical; hydrated, mason's, finishing, chemical; open quarry.

NORTH MOUNTAIN STATES

IDAHO, MONTANA, WYOMING

The amount of lime produced in the North Mountain States is not large, and, except for shipments to Oregon and Washington, it is all consumed locally. In 1924 shipments into Idaho were reported from Nevada, Oregon, Utah, Missouri, and Washington; into Montana from Idaho, Missouri, Washington, and Wisconsin; and into Wyoming from Colorado and Missouri.

The lime-manufacturing plants in the North Mountain States are as follows:

IDAHO

Kootenai County: Bayview—Washington Brick, Lime & Sewer Pipe Co. (address, Spokane, Wash.); high-calcium, high-magnesium; 5 shaft kilns; 30 tons a day; wood; quicklime (lump, ground to ¼ inch), construction, chemical; open quarry.

Lemhi County: Salmon—Idaho Lime Co.; 1 pot kiln; 2 tons a day. Idle 1924.

MONTANA

Deer Lodge County:

Anaconda—Anaconda Copper Mining Co. (address, New York, N. Y.); high-calcium; 1 rotary kiln; bituminous coal; quicklime (pebble), chemical; open quarry; plant started September, 1924.

——— Wm. Lorenz; small plant for local supply.

Lewis and Clark County: Elliston—Elliston Lime Co.; high-calcium; 3 steel draw kilns; 30 tons a day; bituminous coal and wood; quicklime (lump), construction; open quarry.

WYOMING

Carbon County: Rawlins—H. Larsen; construction; small plant.

Fremont County: Lander—J. P. McKenna; small plant; idle 1924.

SOUTH MOUNTAIN STATES

ARIZONA, COLORADO, NEVADA, NEW MEXICO, UTAH

The lime manufactured in the South Mountain States is used chiefly for constructional and chemical purposes. Very little is sold for agriculture. Aside from a small quantity of lime shipped to Hawaii and New Mexico, the lime manufactured in Arizona in 1924 was consumed within the State or shipped to California, where part of it was hydrated. Most of the Colorado production was consumed within the State, the greater part being chemical lime. Lime was shipped into Colorado from Illinois, Missouri, New Mexico, Ohio, Texas, and Utah, the lime consumed in the State being more than the production. Practically all the lime manufactured in Nevada was shipped to California and used chiefly for construction. About half of the lime manufactured in New Mexico was for local or State consumption. Shipments of small quantities to Colorado, Kansas, and Texas were, however, reported in 1924. In Utah 78 per cent of the lime manufactured was used for building. Most of the lime sold was consumed within the State or shipped to California, except small shipments to Arizona, Colorado, Idaho, Nevada, and Oregon. There is comparatively little lime shipped into this group of States and only in Colorado and New Mexico does the consumption exceed the sales.

The lime manufacturers in the South Mountain States are as follows:

ARIZONA

Cochise County: Douglas (near Forrest)—The Paul Quarry; high-calcium, low-magnesium; chemical. New plant put in operation in 1924.

Yavapai County:

Nelson—Grand Canyon Lime & Cement Co. (address, Los Angeles, Calif.); high-calcium; 6 patent kilns; 20–30 tons a day; oil; hydrating plant at Los Angeles, Calif.; quicklime (lump), construction, chemical; hydrated, mason's, finishing, chemical, agriculture; open quarry.

Puntenney—Puntenney Lime Co. (Inc.) (address, Los Angeles, Calif.); high-calcium; 4 patent kilns; 50–60 tons a day; wood; quicklime (lump, crushed), construction, chemical.

COLORADO

El Paso County: Manitou—The Western Lime Co. (address, Denver); high-calcium; 4 gas kilns; 30 tons a day; producer gas; quicklime (lump), construction, chemical; hydrated, mason's, chemical; Clyde hydrator; open quarry.

Fremont County: Calcite—Colorado Lime Corporation (address, Denver); high-calcium; 2 flame kilns; 12 tons a day; bituminous coal; quicklime (lump), construction, chemical; open quarry.

La Plata County: Durango—Farmers Supply Co.; 1 pot kiln; 3 tons a day; bituminous coal; quicklime (lump), construction, chemical.

Pueblo County: Pueblo—The Pueblo Lime Co.: high-calcium; 1 patent kiln; bituminous coal; quicklime (lump), construction. Plant erected 1924. Stone purchased from the E. E. Davis Quarry, Monarch, Colo.

NEVADA

Clark County: Sloan—Nevada Lime & Rock Co.; high-calcium; 1 rotary kiln; 60 tons a day; oil; quicklime (lump), construction; hydrated, mason's, finishing, chemical, agriculture; Raymond hydrator; open quarry.

NEW MEXICO

San Juan County: Kirtland—Edmund Thurland; construction; small plant for local supply.

San Miguel County: Las Vegas Hot Springs—The Canyon Lime Co. (address, East Las Vegas); high-calcium; 1 flame kiln; 12 tons a day; bituminous coal and wood; quicklime(lump), construction, chemical; open quarry.

Santa Fe County: Santa Fe—New Mexico Penitentiary; 1 pot kiln; bituminous coal; construction; small plant for local supply.

UTAH

Beaver County: Beaver—Willard S. Thompson & Son; 2 kilns; wood; quicklime (lump), construction.

Cache County:

Logan—Cache Valley Lime Co., Charles E. Peterson; construction; small plant for local supply.

Cache County—Continued.
  Logan—Jacob P. Peterson; construction; small plant for local supply.
Iron County: Cedar City—Parry Lime Co.; construction; small plant for local supply.
Juab County: Eureka—Chief Consolidated Mining Co. (address, Salt Lake City); high-calcium; 2 pot kilns; 24 tons a day; coke and carbon (by-product of steel plant); quicklime (lump), construction; hydrated, mason's, finishing, chemical; Clyde hydrator; open quarry.
Salt Lake County:
  Salt Lake City—The Langton Lime & Cement Co.; high-magnesium; 4 pot kilns; 24 tons a day; coke breeze; quicklime (lump), construction, chemical; open quarry.
  ——— Western Lime & Silica Co.; high-magnesium; 2 pot kilns; 14 tons a day; coke; quicklime (lump), construction; ready-mixed wet plaster; open quarry.
San Juan County: Blanding—E. Palmer; construction; small plant for local supply.
Tooele County: Grantsville—The Utah Lime & Stone Co. (address, Salt Lake City); high-calcium, high-magnesium; 4 flame kilns; 35 tons a day; bituminous coal and coke; quicklime (lump), construction, chemical; hydrated, finishing, mason's, chemical; Clyde hydrator; open quarry.
Utah County:
  Goshen—L. E. Thomas; construction; open quarry; small plant for local supply.
  Provo—Giles & Peterson (Boardman's kilns); low-magnesium; 3 pot kilns; 15 tons a day; bituminous coal; quicklime (lump), construction.

PACIFIC COAST STATES AND HAWAII

CALIFORNIA, OREGON, WASHINGTON, HAWAII

California is the largest lime producer of the Pacific Coast States. Sixty-nine per cent of its product was sold in 1924 for construction; a comparatively small amount was sold for agricultural purposes and the remainder for chemicals. A small amount of the lime manufactured in California was shipped to Arizona, Nevada, Oregon, and Hawaii, and lime was reported as shipped into the State from Arizona, Missouri, Nevada, Ohio, Utah, and Washington. The total consumption was one and two-thirds times the sales. Lime from Oregon was shipped to Idaho and Utah, and Oregon received lime from California, Idaho, Utah, and Washington. The lime plants in Washington are in the extreme northwestern and northeastern parts of the State. The product is sold chiefly for construction, with small amounts for chemical and agricultural use. The lime used in the State in 1924 was less than the total production, and shipments were reported to California, Idaho, Minnesota, Montana, Oregon, Alaska, Canada, Hawaii, Philippine Islands, Central America, and New Zealand. In return Washington received lime from Idaho, Missouri, and Ohio.

The lime-manufacturing plants in the Pacific Coast States and Hawaii are as follows:

CALIFORNIA

Eldorado County: Newcastle—California Lime Co.; high-calcium; 2 patent kilns; oil; quicklime (lump), construction, agriculture; open quarry. New plant in 1924.
Kern County:
  Tehachapi—Blue Diamond Materials Co. (address, Los Angeles); high-calcium; 5 flame kilns; 20 tons a day; oil; quicklime (lump), construction; open quarry. Plant owned by J. W. Jameson and leased by Blue Diamond Materials Co until March 31, 1924.

Kern County—Continued.

Tehachapi—Union Lime Co. (Inc.) (address, Los Angeles); high-calcium; 8 flame kilns; 48 tons a day; oil; quicklime (lump), construction, agriculture, chemical; plant leased Nov. 15, 1924, from Summit Lime Co., Los Angeles.

San Bernardino County:

Baxter—Pacific Marble Quarries Co. (address, Los Angeles); high-calcium; 2 patent kilns: 15 tons a day; oil; quicklime (lump), construction, chemical; new plant in 1924.

Colton—California Portland Cement Co. (address, Los Angeles); high-calcium; 3 rotary kilns; 60 tons a day; oil; quicklime, construction, chemical.

Santa Cruz County:

Felton—Holmes Lime & Cement Co. (address, San Francisco); high-calcium; 5 pot kilns, 2 patent kilns; 30 tons a day; oil; quicklime (lump), construction, agriculture, chemical; hydrated, mason's, finishing, chemical, agriculture; Clyde hydrator; open quarry.

Rincon—Henry Cowell Lime & Cement Co. (address, San Francisco); high-calcium; 5 flame kilns; 40 tons a day; oil; quicklime (lump), construction, chemical; open quarry.

Watsonville—California Spray Chemical Co.; high-calcium, low-magnesium; 1 pot kiln; quicklime, chemical; burns lime from stone purchased from Pacific Portland Cement Co.

Siskiyou County: Gazelle—Mount Shasta Lime Co.; high-calcium; 1 flame kiln; 7 tons a day; wood; quicklime (lump), construction; open quarry.

Tuolumne County: Sonora—Pacific Lime & Plaster Co. (address, San Francisco); high-calcium; 9 patent kilns; 60 tons a day; oil; quicklime (lump), construction, chemical, agriculture; hydrated, mason's, finishing, chemical, agriculture; Clyde hydrator; tunnel and open quarry.

Ventura County: Santa Susana—Ventura County Lime & Fertilizer Co. Plant under construction in 1924.

OREGON

Baker County: Lime—Sun Portland Cement Co. (address, Portland); high-calcium; 3 pot kilns; 30 tons a day; wood; quicklime (lump), construction, chemical; open quarry.

Grant County: Canyon City—E. A. & D. M. Butler. Small plant for local supply.

WASHINGTON

San Juan County:

Bellingham—Orcas Lime Co. (address, Seattle); high-calcium; 1 continuous kiln; 10 tons a day; wood; quicklime (lump), construction, chemical; hydrated, mason's; special hydrator with revolving drums; open quarry.

Friday Harbor—Henry Cowell Lime & Cement Co. (address, Portland, Oreg.); low-magnesium; 2 pot kilns; 10 tons a day; wood; quicklime (lump), construction; open quarry.

——— Roche Harbor Lime & Cement Co.; high-calcium; 13 flame kilns; 130 tons a day; wood; quicklime (lump), construction, chemical; open quarry.

Stevens County:

Bossburg—Idaho Lime Co.; high-calcium; 3 flame kilns; 30 tons a day; wood; quicklime (lump), construction, chemical; open quarry.

Colville—Crown Willamette Paper Co. (address, San Francisco, Calif.); high-magnesium; 2 pot kilns; 30 tons a day; wood; quicklime, chemical; product all used by company.

Whatcom County: Sumas—International Lime Co.; high-calcium; 4 patent kilns; 50 tons a day; wood; quicklime (lump, ground to 20 mesh), construction, chemical; hydrated, mason's, finishing, chemical, agriculture; Kritzer hydrator; open quarry.

HAWAII

Oahu: Honolulu—Waianae Lime Co.; high-calcium; 2 pot kilns; 24 tons a day; oil; quicklime (lump, ground to 20 mesh), construction, agriculture, chemical; hydrated, mason's, chemical. Stone burned is gathered from the land.

GYPSUM

By K. W. COTTRELL

PRODUCTION

The total quantity of gypsum mined in the United States in 1924 was 5,042,629 short tons, an increase of 289,181 tons, or 6 per cent over 1923. The total value of crude and calcined gypsum sold was $42,724,507, an increase of $7,836,352, or 22 per cent. Of the total quantity mined, 982,108 tons, or 19 per cent, was sold crude; almost all of this was purchased by Portland cement manufacturers for use as retarder in their product. Of the remainder 22,298 tons, or 2 per cent of the quantity sold crude, was sold for use as agricultural gypsum or land plaster. The sales for agricultural purposes decreased 3,128 tons, or 12 per cent, and the proportion of the total crude sales in 1924 was 2 per cent as compared with 3 per cent in 1923. Five States—Iowa, Montana, Nevada, Ohio, and Texas—reported larger sales of agricultural gypsum. Nine States reported smaller sales, the greatest decreases being in Colorado and Kansas.

The sales of crude gypsum to Portland cement factories were 20 per cent larger than in the preceding year. California and Kansas were the only States reporting smaller sales, 7 and 12 per cent, respectively. The increases in sales in some of the other States were 1 per cent in Oregon, 3 per cent each in Michigan and Utah, 37 per cent in Montana, 39 per cent in Oklahoma, and 46 per cent in New York.

The total quantity of Keenes cement sold was 30,620 tons, valued at $428,684. This was an increase of 7,347 tons, or 32 per cent in quantity, and of $105,557, or 33 per cent in value. The average value per ton was $14, an increase of 12 cents.

Plaster board, tile, and blocks were made in 14 States at plants operated by the firms mining the gypsum used in these products. Plants of firms that make these products but do not mine gypsum are not included here because the gypsum they use is already accounted for as plaster sold by the original manufacturers. The figures given for boards and blocks, therefore, do not include the entire production of these articles in the United States. The reader should remember also that the operators' figures for tons of Keenes cement and for plaster and wall boards, as well as for the special tile and blocks sold, do not represent the actual weight of the gypsum content but include the weight of the chemicals used in the manufacture of Keenes cement and the weight of the felt, paper, sawdust, and fiber used in the manufacture of the other products mentioned. Wall board increased 98 per cent in quantity and 80 per cent in value. The average value per ton decreased from $36.16 in 1923 to

$32.85 in 1924. Special tile and blocks increased 4 per cent in quantity and 18 per cent in value. The average value per ton increased from $13.07 in 1923 to $14.74 in 1924.

Gypsum produced and sold in the United States, 1915–1924

Year	Crude produced (short tons)	Value of crude and calcined sold	Year	Crude produced (short tons)	Value of crude and calcined sold
1915	2,447,611	$6,596,893	1920	3,129,142	$24,533,065
1916	2,757,730	7,959,032	1921	2,890,784	23,700,290
1917	2,696,226	11,116,452	1922	3,779,949	29,361,151
1918	2,057,015	11,470,854	1923	4,753,448	34,888,155
1919	2,420,163	15,727,907	1924	5,042,629	42,724,507

Gypsum produced and sold in the United States, 1923–1924, by States

State	Number of active plants reporting	Total quantity produced (short tons)	Sold without calcining [a]		Sold calcined		Total value
			Short tons	Value	Short tons	Value	
1923							
California	3	111,832	85,252	$296,455	24,936	$374,040	$670,495
Iowa	7	685,041	134,895	385,283	431,829	4,983,249	5,368.532
Kansas	3	135,019	54,072	142,250	71,349	700,490	842,740
Michigan	6	586,987	135,616	355,067	341,746	2,897,926	3,252,993
Nevada	4	298,390	24.777	60,368	226,753	1,891,639	1,952,007
NewYork	8	1,361,116	230,080	717,999	823,241	9,626,746	10,344,745
Ohio	3	526,861	18,756	62,167	432,511	4,919,375	4,981,542
Oklahoma	4	290,121	47,041	125,182	202.323	2,123,713	2,248,895
Texas	4	344,104	26.887	59,041	254,512	2,177,983	2,237,024
Utah	3	44,531	5,403	17,809	33,520	269,148	286,957
Wyoming	4	33,644	----------	----------	27,945	176,791	176,791
OtherStates [b]	13	335,802	84,463	355,815	230,713	2,169,619	2,525,434
	62	4,753,448	847,242	2,577,436	3,101,378	32,310,719	34,888,155
1924							
Iowa	6	727,385	151,208	379,429	489,745	5,277,910	5,657,339
Kansas	3	141,908	47,519	116,750	77,796	777,512	894,262
Michigan	8	577,526	124,134	324,140	453,135	5,626,682	5,950,822
Nevada	6	365,714	29,441	61,959	278,467	2,001,130	2,063,089
New York	13	1,474,491	335,841	982,777	1,019,319	13,346,469	14,329,246
Ohio	4	525,485	19,332	56,186	477,845	5,563,913	5,620,099
Oklahoma	5	316,134	64,980	157,748	201,762	2,442,333	2,600,081
Texas	7	402,245	32,245	62,374	301,512	2,566,736	2,629,110
Utah	4	90,221	35,298	43,335	43,590	292,253	335,588
Wyoming	3	32,715	188	473	25,095	189,871	190,344
OtherStates [b]	13	388,805	141,922	489,149	200,303	1,965,378	2,454,527
	72	5,042,629	982,108	2,674,320	3,568,569	40,050,187	42,724,507

[a] Includes agricultural gypsum as follows: 1923, 25,426 tons, valued at $150,026; 1924, 22,298 tons, valued at $125,612.

[b] 1923: Arizona, Colorado, Montana, New Mexico, Oregon, South Dakota, and Virginia; 1924: Arizona, California, Colorado, Montana, New Mexico, Oregon, South Dakota, and Virginia.

Gypsum, produced in the United States, sold in 1924, by uses

	Short tons	Value
Calcined:		
Stucco	600,955	$3,849,971
Neat plaster	1,712,589	13,895,969
Sanded plaster	166,910	1,179,826
Mixed plaster	[a] 193,635	[a] 1,534,836
Plaster of Paris, molding, casting plaster, etc	[b] 193,971	[b] 1,903,493
Keenes cement	30,620	428,684
To plate-glass works	18,847	138,444
Plaster board	86,018	1,924,394
Wall board	391,457	12,859,411
Partition tile	121,604	1,492,550
Special tile or blocks	23,457	345,847
Other purposes [c]	28,506	496,762
	3,568,569	40.050,187
Crude	982,108	2,674,320
	------------	42,724,507

[a] Includes small quantity of wood fiber plaster.
[b] Includes dental plaster.
[c] Includes roof tile and miscellaneous material.

Keenes cement, produced in the United States, sold in 1915–1924

Year	Manufacturers	Short tons	Value	Year	Manufacturers	Short tons	Value
1915	6	16,963	$160,711	1920	6	16,542	$246,433
1916	5	20,358	190,585	1921	7	14,430	232,457
1917	3	15,976	167,191	1922	6	21,991	324,316
1918	5	12,823	151,802	1923	5	23,273	323,127
1919	6	15,395	200,360	1924	6	30,620	428,684

IMPORTS AND EXPORTS[1]

Six companies in the gypsum industry reported to the Bureau of Mines that they imported gypsum in 1924. They were the Connecticut Adamant Plaster Co., Higginson Manufacturing Co., Newark Plaster Co., Rock Plaster Corporation, Charles W. Priddy & Co., and the United States Gypsum Co. The imports reported by these six companies were more than the total reported by the Bureau of Foreign and Domestic Commerce. Of the gypsum imported (as reported by these companies), over 23,000 tons was sold crude, and of this quantity 79 per cent was sold for use in agriculture. More than 450,000 tons was sold calcined and was used mainly in the manufacture of gypsum plasters. It is estimated that the value of the imported gypsum sold crude or in manufactured form by these six firms in 1924 was more than $5,600,000, in comparison with a business of over $42,000,000 based on domestic gypsum.

As a large part of the Canadian output is imported into the United States and is a chief source of supply for the eastern seaboard States, the following table is of interest:

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[1] Figures for imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Gypsum produced and sold in Canada, 1915–1924 [a]

Year	Short tons	Value	Year	Short tons	Value
1915	474, 815	$854, 929	1920	429, 144	$1, 893, 991
1916	342, 915	738, 593	1921	386, 550	1, 785, 538
1917	336, 332	881, 984	1922	559, 265	2, 160, 898
1918	152, 287	823, 006	1923	578, 301	2, 243, 100
1919	299, 063	1, 215, 287	1924	646, 016	2, 208, 108

[a] Dominion Bur. Statistics.

Gypsum imported for consumption in the United States, 1915–1924

Year	Crude		Ground or calcined		Manufactured plaster of Paris	Keenes cement		Total value
	Short tons	Value	Short tons	Value		Short tons	Value	
1915	336, 856	$356, 791	5, 749	$22, 873	$10, 095	427	$6, 656	$396, 415
1916	254, 131	275, 043	11, 706	72, 345	9, 085	600	9, 890	366, 363
1917	240, 269	265, 504	16, 533	109, 732	6, 016	484	8, 003	389, 255
1918	50, 653	55, 004	6, 117	70, 028	1, 765	111	2, 259	129, 056
1919	171, 733	211, 946	10, 415	126, 405	7, 719	187	5, 984	352, 054
1920	282, 486	397, 942	14, 921	179, 191	10, 282	202	5, 338	592, 753
1921	266, 796	364, 318	4, 495	55, 109	33, 072	184	6, 836	459, 335
1922	409, 475	523, 939	1, 774	32, 651	55, 116	403	9, 636	621, 342
1923	448, 129	629, 203	5, 133	77, 716	41, 317	418	11, 543	759, 779
1924	519, 627	724, 864	5, 217	70, 793	48, 059	539	12, 042	855, 758

Gypsum, crude, imported into the United States, 1923–1924, by countries

[General imports]

Country	1923		1924	
	Short tons	Value	Short tons	Value
Australia			2, 576	$2, 300
Canada	446, 790	$620, 211	516, 991	721, 604
England	1, 193	3, 929	20	453
France	103	4, 487	28	334
Germany	35	418	2	8
Hongkong	8	158	10	165
	448, 129	629, 203	519, 627	724, 864

Exports of gypsum are designated as "gypsum or plaster, crude, ground, calcined, and manufactures of," and have been as follows: 1924, 10,623 short tons, valued at $358,425; 1923, 8,815 tons, $226,423; 1922, 7,673 tons, $178,166. Exports are not separately classified for earlier years.

MANUFACTURERS AND MINERS

MANUFACTURERS OF GYPSUM PLASTER

HEAD OFFICES

Alabastine Co., Grand Rapids, Mich.
American Cement & Plaster Co., 617 Clift Building, Salt Lake City, Utah.
American Gypsum Co., Port Clinton, Ohio.
Arizona Gypsum Plaster Co., Douglas, Ariz.
Beaver Products Co. (Inc.), Buffalo, N. Y.
Best Bros. Keenes Cement Co., Medicine Lodge, Kans.
Blue Diamond Materials Co., 2200 East Sixteenth Street, Los Angeles, Calif.
Cardiff Gypsum Plaster Co., Fort Dodge, Iowa.
Centerville Gypsum Co., Centerville, Iowa.
Certain-teed Products Corporation, 100 East Forty-second Street, New York, N. Y.
Colorado Portland Cement Co., Ideal Building, Denver, Colo.
Connecticut Adamant Plaster Co. (importer), New Haven, Conn.
Dakota Plaster Co., Rapid City, S. Dak.
Ebsary Gypsum Co. (Inc.), Scottsville, N. Y.
Empire Gypsum Co., Rochester, N. Y.
Garbutt & Orcutt, 712 Pantages Building, Los Angeles, Calif.
Globe Plaster & Mining Co., 402 Security Building, Kansas City, Mo.
Grand Rapids Plaster Co., Grand Rapids, Mich.
Higginson Manufacturing Co. (importer), Newburgh, N. Y.
Jumbo Plaster & Cement Co., Sigurd, Utah.
Laramie Cement Plaster Co., Laramie, Wyo.
Lycoming Calcining Co., Williamsport, Pa.
Michigan Gypsum Co., Grand Rapids, Mich.
Nephi Plaster & Manufacturing Co., 907 Continental Bank Building, Salt Lake City, Utah.
Newark Plaster Co. (importer), 30 Church Street, New York, N. Y.
Niagara Gypsum Co., Buffalo, N. Y.
Northwest Gypsum Products Co., Lewistown, Mont.
Oakfield Gypsum Products Corporation, Oakfield, N. Y.
Oklahoma Portland Cement Co., Denver, Colo.
Overland Cement Plaster Co., Laramie, Wyo.
Pacific Portland Cement Co., Consolidated, Pacific Building, San Francisco, Calif.
Rock Plaster Corporation (importer), 40 Rector Street, New York, N. Y.
Southern Gypsum Co. (Inc.), North Holston, Va.
Standard Gypsum Co. (Inc.), San Francisco, Calif.
Texas Cement Plaster Co., Oklahoma City, Okla.
Three Forks Portland Cement Co., Denver, Colo.
United States Gypsum Co., 205 West Monroe Street, Chicago, Ill.
Universal Gypsum Co., Chicago, Ill.
Wasem Plaster Co., Fort Dodge, Iowa.
White Star Plaster Co., 1324 Washington Building, Los Angeles, Calif.
Wyoming Cement Plaster Co., Greybull, Wyo.

MANUFACTURERS OF GYPSUM PLASTER WHO OPERATE MORE THAN ONE PLANT

Beaver Products Co. (Inc.)	Fort Dodge, Iowa. Blue Rapids, Kans. Grand Rapids, Mich. Akron, N. Y. Gypsum, Ohio. Acme, Tex.
Certain-teed Products Corporation	Grand Rapids, Mich. Acme, N. Mex. Acme, Okla. Cement, Okla. Gypsum, Oreg. Acme, Tex. Laramie, Wyo.

Colorado Portland Cement Co	Coaldale, Colo.
	Hanover, Mont.
	Red Butte, Wyo.
Grand Rapids Plaster Co	Grand Rapids, Mich.
	Grandville, Mich.
Pacific Portland Cement Co., Consolidated	Plaster City, Calif.
	Gerlach, Nev.
United States Gypsum Co	Amboy, Calif.
	Loveland, Colo.
	Fort Dodge, Iowa.
	Blue Rapids, Kans.
	Alabaster, Mich.
	Grand Rapids, Mich.
	Arden, Nev.
	Oakfield, N. Y.
	Gypsum, Ohio.
	Eldorado, Okla.
	Southard, Okla.
	Piedmont, S. Dak.
	Sweetwater, Tex.
	Plasterco, Va.
Universal Gypsum Co	Fort Dodge, Iowa.
	Akron, N. Y.

MANUFACTURERS OF KEENES CEMENT

American Cement & Plaster Co., Salt Lake City, Utah.
Best Bros. Keenes Cement Co., Medicine Lodge, Kans.
Certain-teed Products Corporation, 100 East Forty-second Street, New York, N. Y.
Nephi Plaster & Manufacturing Co., 907 Continental Bank Building, Salt Lake City, Utah.
Pacific Portland Cement Co., Consolidated, Pacific Building, San Francisco, Calif.
United States Gypsum Co., 205 West Monroe Street, Chicago, Ill.
Wasem Plaster Co., Fort Dodge, Iowa.

MANUFACTURERS OF GYPSUM PLASTER BOARD AND WALL BOARD

American Gypsum Co., Port Clinton, Ohio.
Beaver Products Co. (Inc.), Buffalo, N. Y.
Bell, H. W., & Co., 2592 Park Avenue, New York, N. Y.
Buttonlath Manufacturing Co., Vernon and Boyle Avenues, Los Angeles, Calif.
Duffy, J. P., & Co., Fifty-first Street and Second Avenue, Brooklyn, N. Y.
Empire Gypsum Co., Rochester, N. Y.
Gypsite Fireproofing Co., 2034 Dime Bank Building, Detroit, Mich.
Hercules Plaster Board Co., Hampton, Va.
Kelley Plaster & Plaster Board Co., 261 Central Avenue, Passaic, N. J.
Key Hold Lath Co., 148 Hooper Street, San Francisco, Calif.
New Jersey Adamant Manufacturing Co., 79 Passaic Avenue, East Newark, N. J.
Rader, Gustav, 1105 Metropolitan Avenue, Brooklyn, N. Y.
Reeb, M. A., Corporation, 597 Michigan Avenue, Buffalo, N. Y.
Rock Plaster Corporation (importer), 40 Rector Street, New York, N. Y.
Schumacher Wall Board Co., Fifty-eighth Street and San Pedro and Slauson Avenues, Los Angeles, Calif.
Southern Gypsum Co. (Inc.), North Holston, Va.
United States Gypsum Co., 205 West Monroe Street, Chicago, Ill.
Universal Gypsum Co., Chicago, Ill.

MANUFACTURERS OF GYPSUM BLOCK AND TILE

Alabastine Co., Grand Rapids, Mich.
American Gypsum Co., Port Clinton, Ohio.
Arizona Gypsum Plaster Co., Douglas, Ariz.
Beaver Products Co. (Inc.), Buffalo, N. Y.
Certain-teed Products Corporation, 100 East Forty-second Street, New York, N. Y.

Ebsary Gypsum Co. (Inc.), Scottsville, N. Y.
Empire Gypsum Co., Rochester, N. Y.
Nephi Plaster & Manufacturing Co., 907 Continental Bank Building, Salt Lake City, Utah.
Plymouth Gypsum Co., Fort Dodge, Iowa.
Reeb, M. A., Corporation, 597 Michigan Avenue, Buffalo, N. Y.
United States Gypsum Co., 205 West Monroe Street, Chicago, Ill.
Wyoming Cement Plaster Co., Greybull, Wyo.

MINERS

[Gypsum sold crude only]

Briggs, K. S., El Paso, Tex.
Mammoth Plaster & Cement Co., Cedar City, Utah.
Phoenix Gypsum Co. (Inc.), 621 Mutual Life Building, Buffalo, N. Y.
Regan Bros., Mason, Nev.
Simmons, Arthur, Norwich, N. Y.

USES OF GYPSUM[1]

GENERAL USES

More than 95 per cent of the gypsum mined is used in construction. Calcined to plaster of Paris, it is used extensively as an inside wall plaster and in arid countries some is used as an outside finish. Plaster of Paris sets so quickly that a retarder must be added to insure enough time for mixing and placing in position. The retarders used are mostly organic, such as glue, glycerin, flour, blood, and sugar; other materials, including sand, cut wood fiber, hydrated lime, and hair, are added as fillers. Gypsum plaster is used extensively in building, either precast or poured into place as gypsum wall, or as plaster board, gypsum block or tile, making a good fire-resistant construction.

Another type of gypsum plaster is that commonly known in this country as Keenes cement. It includes not only the original Keenes cement but other cements similarly manufactured and having like properties. They are valued because they are much harder than ordinary gypsum plaster, take a high polish, and as commonly made are much slower setting. In general the process of manufacture is to reburn calcined gypsum which has been mixed with a solution of chemicals that will unite with the lime sulphate to form a double salt. The materials so used include potassium sulphate, sodium sulphate, potassium alum, mixtures of sodium and aluminum sulphate, and borax.

Cements of this type sold in the United States are made by various processes. It seems probable that much of the domestic output is not a reburned mixture, but is made by calcining lump gypsum in stationary kilns, grinding to a very fine powder, and adding mixtures of aluminum and sodium sulphate and a small amount of borax.

Another large use of gypsum is as a retarder in Portland cement. Without a retarder Portland cement begins to set in a few minutes, hence the addition of a substance to delay setting is usually necessary. Either raw or calcined gypsum may be used, and cement manufacturers naturally employ the cheaper raw material. It is probable, however, that in grinding the cement and retarder the heat developed calcines at least part of the gypsum to plaster of Paris.

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[1] Data prepared by Marie Farnsworth, of the Bureau of Mines.

Other smaller uses of gypsum, either crude or calcined, are as land plaster or fertilizer, crayons, terra alba for fillers, plate-glass beds, pottery and terra-cotta molds, statuary and other art work, foundry molds, surgical casts, dental plaster, gypsum paint, and even in road building in climates that are sufficiently arid.

NEWER USES

Construction.—Calcined gypsum is being employed more and more extensively in construction. Its lightness, its excellence as a nonconductor of heat, and its strength with only slight reinforcing are properties that are each year receiving more recognition. It can be precast or poured into place, and the ease with which its setting time can be controlled gives it wide usefulness as a structural material. With the increase in use, better methods of manufacture are being employed. In many plants machine molding has replaced hand molding in the making of gypsum blocks and tile. Two kinds of continuous, practically automatic, block and tile-making machines have been introduced as well as some excellent wall-board machines. An important development in the wall-board industry is the perfecting of an automatic wall-board drying machine which has doubled or tripled the capacity of wall-board plants.

A form of gypsum concrete known as structolite has been introduced during the past year. Plaster of Paris is mixed with an aggregate and poured to form the main walls and partitions of lightweight dwellings. Structolite is also used for bearing walls in one-story factory buildings and is recommended for curtain fire-stop and other walls in heavy-type industrial and commercial buildings where the main loads are supported by steel or Portland cement concrete. It is fireproof, although it is calcined somewhat by the heat, and the water then washes off the plaster of Paris formed, leaving a pitted surface. Structolite is said to have good thermal insulation. Its compressive strength when mixed neat is said to be about 2,500 pounds per square inch as against 800 pounds for plaster of Paris used in other poured or precast construction. When mixed with standard aggregate it develops an ultimate compressive strength of at least 800 pounds per square inch, which permits a factor of safety of 10 in ordinary residential design. Structolite gives good insulation of sound; partitions of it are claimed to be 60 per cent more effective as nonconductors of sound than clay-tile partitions. Structolite is light in weight, weighing only 85 pounds per cubic foot (the weight of cement concrete is 150 pounds). Its rapid set makes rapid construction possible and it is claimed to be very adaptable.

One of the new forms of precast gypsum products for construction work known as "Rockwood gypsum lumber" has been developed by the Rockwood Corporation, St. Louis, Mo. It is made of plaster of Paris mixed with fiber as a binder. It is formed into hollow blocks and slabs, available in many shapes and lengths, and so constructed that they can be planed, nailed, drilled, sawed, and handled like wooden lumber. It is claimed that Rockwood lumber can be used efficiently in building of nonbearing interior walls, exterior or interior bearing walls, and floors and roofs.

Another interesting construction material introduced during the past year is a porous insulating material known as insulex. This is a gypsum product to which are added certain chemicals. When mixed with water these chemicals produce a gas, causing the mass to increase in bulk several times. It is then poured into place. The material sets in about 30 minutes, producing a product filled with multitudes of tiny air cells.

A new hydraulic gypsum cement known as astroplax has been put on the market by a manufacturing firm in Scotland. The most unusual property claimed for it is that the set is not affected detrimentally by disturbance. It is also claimed that old batches can be mixed up with new batches and thickened or thinned as required. This claim has not been confirmed.

Agriculture.—Gypsum is used extensively in agriculture for reclaiming black alkali soils. It unites with the sodium carbonate present and forms sodium sulphate and calcium carbonate. This reaction is reversible in the presence of carbonic acid, so that provision should be made for carrying away the sodium sulphate.

Its greatest value as a soil conditioner is in the production of legumes, especially alfalfa, clover, beans, vetch, peanuts, and peas. Besides being a source of sulphur, it increases the growth of legumes by increasing the supply of organic nitrogen in root nodules. This nitrogen is changed through the action of bacteria into nitrates. The fertilizing value of gypsum is also due to the fact that it decomposes the silicates in the earth and makes soluble the potash bound up in the silicates.

Gypsum applied to manure stops the waste of ammonia and also prevents the disagreeable odor of ammonia in stables. The preservation of nitrogen is accomplished through combination of the gypsum with the volatile ammonium carbonate to form the much more stable salt, ammonium sulphate.

Possible therapeutic uses.—A few people claim that gypsum prevents tuberculosis and even assists in the cure. Although the evidence presented in support of the claims for therapeutic value is not conclusive, it is noteworthy that virtual absence of tuberculosis among men working in gypsum mines and mills has been frequently reported. It has also been claimed that gypsum used in stables is helpful in the control of foot-and-mouth disease and tuberculosis of cattle and that gypsum is superior to lime dust for use in and around poultry houses.

Other uses.—In some places in Germany gypsum is being used to fix synthetic ammonia. Ammonia and carbon dioxide are forced into a slurry of gypsum. Ammonium sulphate and precipitated limestone are the resulting products.

Gypsum wastes resulting from the manufacture of phosphoric acid and monocalcium phosphate may be turned into valuable products. In the manufacture of phosphoric acid about half the materials used are converted into gypsum. Heretofore this gypsum has not been used because of its finely divided form and its contamination with acid. A process has been worked out whereby the acid is neutralized and the product centrifuged to make it more compact. The resulting gypsum can be calcined and used as ordinary plaster of Paris.

Utilization of anhydrite.—A method for converting anhydrite to gypsum has been devised by the Bureau of Mines. Tests have shown that anhydrite can be hydrated by very fine grinding. With an average particle size of 7 microns the time required for complete hydration is about three weeks. The gypsum so formed can be used as a retarder in Portland cement and makes an excellent plaster of Paris. Experiments have shown that, although anhydrite alone is a poor substitute for gypsum as a cement retarder, it gives good results when mixed with gypsum.

ABRASIVE MATERIALS

By Frank J. Katz [1]

INTRODUCTION

The production of natural abrasive materials is a varied industry in which a considerable number of widely scattered dissimilar enterprises are engaged in placing different commodities on the markets. By present-day standards in mining and manufacturing few, if any, of these enterprises would be considered large. Nevertheless, individually as well as collectively, they are important elements in the industrial life of the country, inasmuch as they supply tools for grinding, polishing, and other abrasive operations and the ingredients of cleansing compounds, without which the great wood, leather, and metal working and other industries and many householders would be put to great expense and inconvenience in the use of substitutes.

This chapter considers mineral products which as such or as essential constituents of manufactured products are used as abrasive materials. Some of these mineral products are used in other ways also—for example, tripoli as a filler and diatomaceous earth for thermal insulation. With these minerals segregation of production according to uses is difficult, but the total production for all uses is shown in this report. Feldspar and quartz, both of which are used as abrasives, are excluded from this report because that is not their principal use and because precise separation of the statistics according to uses is impossible. Therefore they are considered in other chapters of Mineral Resources, entitled "Feldspar" and "Silica."

Statistics on artificial abrasives are included for comparison and because of their strong influence on the marketing of natural abrasives.

NATURAL ABRASIVES

Under the head of natural abrasives in this report are included millstones and related quarry products, such as chasers, dragstones, and paving stone for chaser mills; grindstones and pulpstones; oilstones, whetstones, hones, scythestones, and rubbing stones; corundum and emery; abrasive garnet; tripoli; diatomaceous earth; pumice; and pebbles and lining for tube mills. These natural abrasives were produced in 1924 in 27 States, as follows:

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[1] Statistics of domestic production were compiled by Miss A. T. Coons and Miss B. H. Stoddard, and those of world production by Miss L. M. Jones, all of the Bureau of Mines. Data on imports and exports were compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Arkansas	Oilstones.
California	Diatomaceous earth, grinding pebbles, and pumice.
Connecticut	Diatomaceous earth.
Illinois	Tripoli.
Indiana	Rubbing stones, scythestones, and whetstones.
Kansas	Pumice.
Kentucky	Scythestones and whetstones.
Maryland	Diatomaceous earth.
Michigan	Grindstones.
Minnesota	Grinding pebbles and tube-mill lining.
Missouri	Tripoli.
Nebraska	Pumice.
Nevada	Diatomaceous earth.
New Hampshire	Diatomaceous earth, garnet, millstones, and scythestones.
New York	Diatomaceous earth, emery, garnet, and millstones.
North Carolina	Millstones.
Ohio	Grindstones, pulpstones, rubbing stones, scythestones, and whetstones.
Oklahoma	Tripoli.
Oregon	Diatomaceous earth.
Pennsylvania	Rottenstone.
South Dakota	Grinding pebbles and tube-mill lining.
Tennessee	Tripoli.
Utah	Diatomaceous earth and pumice.
Vermont	Scythestones.
Virginia	Emery and millstones.
Washington	Diatomaceous earth, pulpstones, and rubbing stones.
West Virginia	Grindstones and pulpstones.

MILLSTONES

American millstones have been and are still for the most part made of quartz sandstone and conglomerate, chiefly in Ulster County, N. Y., and Montgomery County, Va., but also in Pennsylvania. Millstones are also made of granite, particularly in Alabama, Maine, Minnesota, New Hampshire, and North Carolina. The production recorded in Mineral Resources includes only the stones made for other than purely local use. Doubtless a large number of stones have been made in many unrecorded localities as local use has required, and they have been made of other rocks than those specified, particularly in the mountain sections of the Southern States. Formerly the millstone manufacturing industry was much larger than at present. About 1880 the total value of the stones produced and sold in the United States was around $200,000 annually. The production has declined since the late eighties and during the last four years has been from $20,000 to $30,000 worth of stones annually. The decline is due in part to the fact that the manufacture of millstones is a hand craft in which, as in many others in the United States, the old master craftsmen who are gradually disappearing are not being replaced. In part also the change is due to new processes in the grain, paint, and mineral milling industries in which the old-style burrstones and chaser mills are being supplanted by grinding equipment of an entirely different type.

The value of the millstones (burrstones) and related quarry products—chasers, dragstones, and pavers—sold by producers in the United States in 1924 was more than in 1921 to 1923, but less than in other years since 1910.

Value of millstones, chasers, and dragstones sold by producers in the United States, 1915–1924

Year	New York		Other States [a]		Total	
	Producers	Value	Producers	Value	Producers	Value
1915	12	$16,883	7	$36,597	19	$53,480
1916	10	10,287	10	34,272	20	44,559
1917	10	22,103	8	21,386	18	43,489
1918	14	25,488	13	67,026	27	92,514
1919	7	10,155	11	56,817	18	66,972
1920	8	13,331	11	49,994	19	63,325
1921	12	14,672	7	9,852	19	24,524
1922	12	17,025	4	3,828	16	20,853
1923	17	14,344	4	7,885	21	22,229
1924	17	18,215	5	11,910	22	30,125

[a] 1915: North Carolina, Pennsylvania, and Virginia; 1916, 1917, and 1919: Alabama, North Carolina, Pennsylvania, and Virginia; 1918: Maryland, North Carolina, Pennsylvania, and Virginia; 1920: Alabama, Maryland, North Carolina, and Virginia; 1921: Alabama, New Hampshire, North Carolina, and Virginia; 1922: Alabama, North Carolina, and Virginia; 1923: Maine, Minnesota, North Carolina, and Virginia; 1924: New Hampshire, North Carolina, and Virginia.

GRINDSTONES AND PULPSTONES

Grindstones and pulpstones are made from sandstone quarried in northeastern and eastern Ohio, western West Virginia, eastern Michigan and, during the last few years, in Pierce County, Wash. In 1924 there was a decrease of 18 per cent in the total quantity of grindstones and pulpstones sold, as compared with 1923. The total value of such stones sold by producers in 1924 was $1,666,669.

Grindstones and pulpstones sold by producers in the United States, 1915–1924

Year	Grindstones		Pulpstones		
	Short tons	Value	Pieces	Short tons	Value
1915	42,623	$564,340	696	([a])	$84,139
1916	50,839	631,497	1,066	([a])	134,643
1917	54,432	806,896	2,325	([a])	340,888
1918	56,554	1,262,602	2,921	8,785	513,680
1919	40,755	993,959	2,450	6,110	342,056
1920	44,832	1,239,990	2,321	8,652	467,014
1921	16,310	477,259	2,941	10,030	750,063
1922	21,367	574,900	[b] 1,619	[b] 5,157	[b] 445,286
1923	37,384	1,008,899	2,533	9,186	680,416
1924	28,991	852,260	2,660	9,193	814,409

[a] Figures not available.

[b] Exclusive of sales in Washington prior to 1923.

The companies producing grindstones and pulpstones in the United States in 1924, with the location of the deposits from which the stone was obtained, were as follows:

Michigan:
  Huron County—Grindstone City—The Cleveland Stone Co. (address, Cleveland, Ohio)—Grindstones.
Ohio:
  Columbiana County—
    East Liverpool—The International Pulpstone Co. (address, Elyria)—Pulpstones.
    Lisbon—The Smallwood-Low Co.—Pulpstones.

Ohio—Continued.
  Cuyahoga County—Berea—The Cleveland Stone Co. (address, Cleveland)—Grindstones, lathe stones, square stones, etc.
  Holmes County—
    Glenmont—The Briar Hill Stone Co.—Grindstones.
    Killbuck—Mount Pisbia Stone Co.—Grindstones.
  Jefferson County—
    Empire—The Smallwood Stone Co. (address, Steubenville)—Pulpstones.
    Steubenville—The General Stone Co. (address, Amherst)—Pulpstones.
  Lorain County—
    Amherst—The Ohio Quarries Co. (address, Cleveland)—Grindstones.
    Amherst and Westview—The Cleveland Stone Co. (address, Cleveland)—Grindstones.
  Washington County—
    Brokaw, Gravel Bank, Hayward, and Marietta (Finch Quarry)—The Cleveland Stone Co. (address, Cleveland)—Grindstones.
    Constitution—The Constitution Stone Co.—Grindstones.
    Marietta—
      The Eureka Stone Co.—Grindstones.
      The Hall Grindstone Co.—Grindstones.
      The Marietta Stone Co.—Grindstones and pulpstones.
      Ohio Valley Stone Co.—Grindstones.
Washington: Pierce County—Wilkeson—Walker Cut Stone Co. (address, Tacoma)—Pulpstones.
West Virginia:
  Jackson County—Sherman—The Eureka Stone Co. (address, Marietta, Ohio)—Grindstones.
  Monongalia County—Opekiska—The Smallwood Stone Co. (address, Steubenville, Ohio)—Pulpstones.
  Pleasants County—St. Marys—The Cleveland Stone Co. (address, Cleveland, Ohio)—Grindstones and pulpstones.
  Wetzel County—Littleton—
    American Stone Co.—Pulpstones.
    C. & M. Quarries Co.—Pulpstones.
    Southern Stone Co.—Pulpstones.

OILSTONES AND SCYTHESTONES

Oilstones were produced from novaculite quarried in Arkansas; whetstones and scythestones from sandstone quarried in Indiana, Kentucky, and Ohio; scythestones from schist quarried in New Hampshire and Vermont; and rubbing stones from sandstone quarried in Indiana, Ohio, and Washington.

Oilstones, whetstones, hones, scythestones, and rubbing stones sold by producers in the United States, 1915–1924

Year	Short tons	Value	Year	Short tons	Value
1915	(a)	$115,175	1920	1,144	$231,747
1916	(a)	154,573	1921	831	173,025
1917	1,816	168,704	1922	1,016	197,450
1918	1,010	189,033	1923	1,223	231,812
1919	1,463	235,943	1924	1,056	258,943

[a] Figures not available.

The manufacturers of oilstones, whetstones, scythestones, and rubbing stones from natural stone in 1924 and the source of their raw material were as follows:

The American Rubbing Stone Co., Cincinnati, Ohio: Whetstones and rubbing stones; manufactured from sandstone quarried at Floyds Knobs, Floyd County, Ind.

The Bracher Co., Belleville, N. J.:
  Oilstones; manufactured from novaculite obtained from quarries near Hot Springs, Garland County, Ark.
  Scythestones and whetstones; manufactured from sandstone obtained from the Kentucky Bluestone Co., Bluestone, Rowan County, Ky.
The Cleveland Stone Co., Cleveland, Ohio: Scythestones and holy-stones; manufactured from stone obtained at Berea, Cuyahoga County, and Amherst, Lorain County, Ohio.
Pike Manufacturing Co., Pike, N. H.:
  Oilstones; manufactured from novaculite obtained from quarries near Hot Springs, Garland County, Ark.
  Whetstones; manufactured from sandstone obtained from quarries near West Baden, Orange County, Ind. Also manufactured from sandstone obtained from the quarries of the Waller Bros. Stone Co., McDermott, Scioto County, Ohio.
  Scythestones; manufactured from schist quarried at Pike, Grafton County, N. H. Also manufactured from schist quarried at Brownington, Orleans County, Vt.
James H. Rhodes & Co. (Inc.), Chicago, Ill.: Rubbing stones; manufactured from sandstone quarried at New Albany, Floyd County, Ind.
Scranton Whetstone & Abrasive Co., Scranton, Pa.:
  Oilstones; manufactured from novaculite obtained from quarries near Hot Springs, Garland County, Ark.
  Whetstones; manufactured from sandstone obtained from quarries near West Baden, Orange County, Ind.
Tenino Stone Co. (Inc.), Tenino, Wash.: Holy-stones; manufactured from sandstone quarried at Tenino, Thurston County, Wash.
West Baden Whetstone Co., J. A. Chaillaux, West Baden, Ind.: Scythestones; manufactured from sandstone quarried at West Baden, Orange County, Ind. Stone also sold to other companies for the manufacture of whetstones.

CORUNDUM AND EMERY

The domestic sources of emery are in the Peekskill region, N. Y., and Pittsylvania County, Va. The good emery in the deposits formerly worked in the vicinity of Chester, Hampden County, Mass., appears to be exhausted.

Corundum resources were formerly exploited in a large number of localities in the Appalachian section of North Carolina and Georgia. There has been no regular production of corundum in the United States since 1906, although small lots were mined and sold during the World War. In 1924 the quantity of emery produced almost equaled that for 1923 when the production recovered from the severe slump of 1921 and 1922 and nearly reached the quantity recorded in 1919 and 1920.

Although domestic emery does not enjoy the reputation for high quality accorded to Grecian and Turkish emery, it nevertheless appears to be very satisfactory for certain grinding and polishing operations.

Emery sold or used by producers in the United States, 1915–1924

Year	Short tons	Value	Year	Short tons	Value
1915	[a] 3,063	[a] $31,131	1920	2,327	$21,685
1916	15,282	123,901	1921	305	2,250
1917	[b] 17,135	[b] 241,050	1922	1,468	17,511
1918	[c] 10,422	[c] 112,878	1923	2,286	29,478
1919	2,601	23,203	1924	2,195	19,756

[a] Estimated.
[b] Includes 820 short tons of corundum, valued at $67,461.
[c] Includes corundum.

GARNET

Abrasive garnet is produced in Essex, Hamilton, and Warren Counties, N. Y.; Merrimack County, N. H.; and Clay and Jackson Counties, N. C. In former years a little was produced in Pennsylvania and Connecticut. The chief producing region is Warren County, N. Y. In 1923 the output of abrasive garnet rose to an unprecedented figure, and the average value at the mines was approximately $76 a ton. The quantity produced in 1924 was less, but the average value increased to $81 a ton. The figures indicate an unusual growth in the use of garnet as an abrasive material and the recognition of the peculiar worth of garnet in certain processes, especially the finishing of wood and leather and the manufacture of shoes. In these processes garnet is used chiefly in the form of a coating on paper or cloth and also on belts and specially shaped forms.

The Bureau of Mines has recently published Bulletin 256 entitled "Garnet; its Mining, Milling, and Utilization," by W. M. Myers and C. O. Anderson.

Abrasive garnet sold or used by producers in the United States, 1915–1924

Year	Short tons	Value	Year	Short tons	Value
1915	4,301	$139,584	1920	5,476	$434,425
1916	6,171	208,850	1921	3,048	260,687
1917	4,995	198,327	1922	7,054	566,879
1918	4,696	248,161	1923	9,006	688,437
1919	4,944	310,131	1924	8,290	674,176

TRIPOLI

The material called tripoli in the trade in the United States is a white, yellowish, or pinkish, light, porous, absorbent, and generally pure siliceous rock that has resulted from the leaching of calcareous material from highly siliceous limestone or highly calcareous chert, or from the leaching of fine-grained siliceous shale by a process that leaves only silica, or from the chemical weathering and disintegration of novaculite. In its origin and properties and in some of its uses tripoli is like "rottenstone," a small output of which is here reported with tripoli. The "rottenstone" produced in Pennsylvania and also "rottenstones" from England and Scotland appear on examination to be essentially very fine-grained argillaceous material and therefore quite different from tripoli in composition.

The principal commercial sources of tripoli are southwestern Missouri, southeastern Oklahoma, and southern Illinois. The occurrence of tripoli is also known at several localities in the Appalachian region of the Southern States, especially in Tennessee and in Georgia, where there has been some production. Tripoli is also abundant in the Ozark Mountain region of Arkansas.

Some of the Missouri-Oklahoma tripoli is produced primarily for use as an abrasive, and some of it is mined to be worked up into filter blocks, the cuttings and waste from the making of which are ground and prepared for abrasive and other uses. The larger part of the Missouri output is used as filler, for foundry facings, and in many other ways. The Illinois product is generally known simply as "silica," and though used to some extent as an abrasive for metal polishes, in soaps, and in cleansers, it is very largely used in paint and fillers, in making glass, in the body and enamel of ceramic wares, and for facing foundry molds.

It is not possible to determine the amounts of tripoli used as abrasive material and otherwise, nor to obtain from the producers uniform reports on the quantity and value of the crude or rough quarried material, as they sell much of the product originally in some manufactured or prepared form. Statistics herein reported and in earlier chapters of Mineral Resources therefore do not permit satisfactory comparison between years or between producing States. In the following table the value for the total output of crude tripoli is in part an arbitrarily assigned value, inasmuch as much of the output is not sold crude but in ground or other prepared form by the original producers. The values given "as sold" are the total realizations as reported by producers, and include receipts from sales of both crude and ground or otherwise finished material.

Tripoli (including Pennsylvania rottenstone) sold or used by producers in the United States, 1915 to 1924

Year	Illinois			Other States [a]			Total		
	Short tons	Value		Short tons	Value		Short tons	Value	
		Crude (estimated)	As sold (crude and finished)		Crude (estimated)	As sold (crude and finished)		Crude (estimated)	As sold (crude and finished)
1915	23, 756	$59, 390	([b])	6, 955	$69, 567	([b])	30, 711	$128, 957	([b])
1916	33, 187	82, 968	([b])	10, 070	132, 248	([b])	43, 257	215, 216	([b])
1917	16, 133	31, 338	$207, 738	9, 936	61, 078	$130, 450	26, 069	92, 416	$338, 188
1918	12, 004	18, 902	100, 126	7, 978	34, 913	99, 728	19, 982	53, 815	199, 854
1919	13, 014	32, 961	116, 492	11, 278	65, 049	65, 049	24, 292	98, 010	181, 541
1920	24, 458	66, 509	360, 651	15, 775	97, 567	209, 026	40, 233	164, 076	569, 677
1921	7, 765	27, 333	125, 352	4, 575	26, 559	87, 661	12, 340	53, 892	213, 013
1922	18, 747	54, 741	194, 371	11, 458	50, 568	122, 357	30, 205	105, 309	316, 728
1923	11, 522	31, 230	117, 201	15, 560	30, 960	265, 556	27, 082	62, 190	382, 757
1924	13, 466	23, 566	116, 188	15, 010	31, 971	273, 221	28, 476	55, 537	389, 409

[a] 1915: Georgia, Missouri, and Pennsylvania; 1916-1923: Missouri, Oklahoma, and Pennsylvania; 1924: Missouri, Oklahoma, Pennsylvania, and Tennessee.

[b] Figures not available.

DIATOMACEOUS EARTH

Diatomaceous earth, also called infusorial earth and sold under various trade names, is a light earthy material which as obtained from some sources is loose and powdery, and from others is more or less firmly coherent. Much of it resembles chalk or clay, but it can be distinguished at once from chalk by the fact that it does not effervesce when treated with acids. It is generally white or gray but may be yellowish, pinkish, or brown, owing to the presence of impurities, or even black when mixed with much organic matter. Diatomaceous earth is made up of the remains of minute aquatic plants and is composed chemically of hydrous silica.

Deposits of diatomaceous earth are widespread in many parts of the Western States, particularly California, Idaho, Oregon, Washington, and Nevada, where in some places it occurs in very thick beds which are remarkably uniform and pure. Diatomaceous earth is also widespread in beds underlying the coastal region of Maryland and Virginia, occupying the triangular area roughly marked by Annapolis on the northeast, Richmond on the southwest, and the Dismal Swamp region on the southeast. In this region, however, the beds vary in quality or degree of purity and in thickness and are not known to be continuous, though some excellent diatomaceous material has been found within the region. In the northern part of the United States, especially that part geologically known as the glaciated region, and also in the lake region of Florida, diatomaceous deposits on lake bottoms or beneath accumulations of muck in swamps are also abundant.

At present the production of diatomaceous earth in the United States is practically limited to the thick beds of pure earth in California, Oregon, Washington, and Nevada. A little is produced in New York and Maryland and at irregular intervals in several other States.

Diatomaceous earth sold or used by producers in the United States, 1915 to 1924

Year	Short tons	Value	Year	Short tons	Value
1915 [a]	4,593	$38,517	1920	61,922	$1,079,693
1916 [a]	2,721	26,337	1921	[b] 55,134	[b] 682,616
1917 [a]	3,033	31,368	1922	44,761	386,669
1918 [a]	2,965	24,947	1923	65,833	699,406
1919	42,642	531,960	1924	63,163	693,917

[a] Exclusive of considerable production for special uses upon which the Bureau of Mines is not at liberty to report.

[b] Partly estimated.

PUMICE

The domestic product sold as pumice is almost wholly a finely fragmental volcanic glass or so-called volcanic dust or "ash." This material is dug from deposits in which it is interbedded with other sedimentary materials or from deposits of "ash" that blanket the surface. The chief sources of production are in Kansas and Nebraska, but small quantities have been produced in California and other Western States. The domestic production in recent years has included also some lump pumice produced in Arizona and California. This lump pumice is fairly comparable with the imported Italian pumice, which formerly constituted the bulk of the pumice used in this country. Much of the Italian pumice was crushed and ground for use in the form of powder, and in that state it was not appreciably different from the domestic volcanic dust or "ash," which is a satisfactory substitute for it.

Pumice sold or used by producers in the United States, 1915–1924

Year	Short tons	Value	Year	Short tons	Value
1915	27,708	$63,185	1920	41,838	$114,433
1916	33,320	82,263	1921	37,108	158,540
1917	35,293	84,814	1922	45,262	175,600
1918	30,637	91,178	1923	56,575	214,169
1919	36,051	116,835	1924	43,651	190,253

PEBBLES FOR GRINDING AND FLINT LINING FOR TUBE MILLS

The production of pebbles used for grinding minerals, ores, and cement ingredients and clinker, and for other purposes, together with the output of quartzite blocks for use as tube-mill liners, reported below includes only the output of beach pebbles in southern California and of cut cubes or pebbles and liners made of quartzite in Minnesota and South Dakota. The figures appear to cover the entire commercial output, but there was doubtless an unrecorded additional production for local use by the producing concerns.

The production in 1924 showed a considerable decrease from 1923, and was far below the output during the years 1917–1920, when efforts of domestic producers were stimulated by a threatened shortage of the supply of imported pebbles during the period of the war.

Pebbles for grinding and flint lining for tube mills sold or used by producers in the United States, 1915–1924

Year	Short tons	Value	Year	Short tons	Value
1915	(a)	(a)	1920	10,924	$77,823
1916	[b] 6,345	[b] $42,500	1921	989	14,637
1917	15,050	131,441	1922	3,159	30,798
1918	12,469	129,485	1923	4,551	51,795
1919	9,448	85,302	1924	2,532	37,429

[a] Figures not available prior to 1916.
[b] Grinding pebbles only. Figures for tube-mill lining not available.

IMPORTS AND EXPORTS

Value of abrasive materials imported for consumption in the United States, 1921–1924

Material	1921	1922	1923	1924
Millstones and burrstones	$13,556	$15,356	$20,102	$6,311
Grindstones and pulpstones	81,880	81,733	106,028	122,440
Hones, oilstones, and whetstones	35,761	48,938	53,233	43,579
Emery and corundum	393,454	389,390	722,688	364,755
Diatomaceous earth, tripoli, and rottenstone	13,203	10,429	11,779	9,504
Pumice	173,201	118,458	128,693	111,284
Diamond dust and bort	466,345	1,029,261	228,409	259,482
Flint, flints, and flintstones, unground	116,157	145,805	130,974	114,958
Garnet	(a)	[a] 1,837	93,803	54,402

[a] Not separately classified prior to new tariff, Sept. 22, 1922.

The figures for millstones and burrstones may be divided as follows: Rough, 1921, $3,075; 1922, $7,412; 1923, $17,214; 1924, $5,720; made into millstones, 1921, $10,481; 1922, $7,944; 1923, $2,888; 1924, $591.

Emery and corundum imported for consumption in the United States, 1921–1924

Year	Grains		Ore and rock		Other manufactures
	Pounds	Value	Long tons	Value	
1921	1,504,971	$82,771	6,169	$281,931	$28,752
1922	381,222	16,643	5,297	329,902	42,845
1923	427,567	18,721	11,362	610,518	93,449
1924	416,895	17,820	9,275	292,817	54,118

"*Flint, flints, and flintstones (unground)*" *imported into the United States, 1921 -1924*

[General imports]

Country	1921		1922		1923		1924	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Argentina							([a])	$20
Belgium	1, 365	$23, 404	902	$15, 460	2, 012	$22, 152	1, 930	26, 089
Canada	280	1, 510	193	920	766	3, 409	6	84
Czechoslovakia					32	484		
Denmark	3, 249	36, 924	4, 807	51, 076	3, 908	43, 886	3, 681	33, 892
England			([a])	8	34	365	9	157
France	5, 188	54, 248	9, 723	73, 636	8, 955	57, 401	11, 635	53, 080
Germany	2	53	251	2, 932	226	2, 572	184	1, 497
Ireland							28	139
Japan					([a])	5		
Netherlands			58	681				
Norway			50	421	19	700		
Poland and Danzig			56	671				
Scotland	([a])	18						
	10, 084	116, 157	16, 040	145, 805	15, 952	130, 974	17, 473	114, 958

[a] Less than 1 ton.

Value of domestic abrasive materials exported, 1921–1924

Material	1921	1922	1923	1924
Grindstones	$281, 976	$281, 413	$499, 123	$481, 397
Abrasive wheels, emery, and other	1, 318, 804	644, 151	571, 733	521, 840
All other natural abrasives, hones, whetstones, etc	1, 719, 810	292, 051	342, 737	173, 731

WORLD'S PRODUCTION

World's production of natural abrasives, 1920–1924, in metric tons

	1920	1921	1922	1923	1924
Corundum:					
Australia, Western (exports	([a])	([b])	----------	----------	----------
Canada	178	366	----------	----------	----------
India, British	213	65	----------	----------	----------
Madagascar	521	285	186	421	147
Russia	63	7	2	([a])	([a])
Union of South Africa	236	112	1, 836	2, 554	1, 695
Diatomaceous earth:					
Algeria	1, 500	800	2, 480	10, 000	[c] 9, 092
Australia—					
New South Wales	390	209	489	523	573
Victoria	1, 016	----------	----------	----------	----------
Chosen	28, 820	24, 313	38, 904	----------	----------
France	3, 800	4, 580	4, 620	([a])	([a])
Germany (exports)	4, 943	[d] 3, 415	5, 207	4, 096	4, 326
Ireland (northern)	[c] 6, 203	[c] 4, 228	1, 909	1, 680	2, 480
Italy	25	875	175	420	420
Norway (exports)	75	113	82	110	([a])
Sweden	([a])	600	322	696	608
United States	56, 174	50, 016	40, 606	59, 722	57, 300
Emery:					
Germany (Bavaria)	140	243	420	400	([a])
Greece	11, 089	12, 709	13, 000	21, 626	23, 000
Russia	676	592	([a])	([a])	([a])
Turkey	([e])	([e])	([e])	([e])	([e])
United States	2, 111	277	1, 332	2, 074	1, 991
Garnet:					
Canada	----------	----------	----------	1, 134	327
Madagascar	----------	----------	10	5	----------
Spain	198	5	([a])	982	1, 112
United States	4, 968	2, 765	6, 399	8, 170	7, 521
Grinding pebbles and tube-mill lining:					
Denmark	11, 162	13, 000	15, 726	20, 914	25, 570
France	([f])	([f])	([f])	([f])	([f])
United States	9, 910	897	2, 866	4, 129	2, 297
Grindstones and pulpstones:					
Canada (grindstones)	2, 217	1, 162	912	1, 827	2, 441
Italy (grindstones)	1, 410	860	875	960	860
United States	48, 520	23, 895	24, 062	42, 247	34, 640
Millstones:					
France	19, 240	19, 300	19, 105	([a])	([a])
Greece (sales)	[g] 2, 728	[g] 14, 348	[g] 5, 324	[g] 1, 705	[g] 2, 869
Italy	1, 857	1, 934	1, 885	2, 220	2, 300
United States	([h])	([h])	([h])	([h])	([h])
Yugoslavia (exports)	334	([a])	([a])	[g] 46	([a])
Oilstones, scythestones, etc.:					
Belgium (whetstones)	[g] 67, 800	[g] 77, 550	[g] 68, 930	[g] 207, 950	([a])
France (whetstones)	500	850	778	([a])	([a])
Germany (Bavaria) (whetstones)	15	29	43	42	([a])
Italy (honestones)	630	681	372	452	517
United States	1, 038	754	922	1, 109	958
Pumice:					
Italy	25, 200	10, 968	21, 036	30, 473	31, 094
New Zealand	2, 889	2, 992	3, 068	[c] 3, 776	[c] 1, 655
United States	37, 955	33, 664	41, 061	51, 324	39, 599
Tripoli:					
Canada (tripolite)	236	309	199	118	30
France	54	34	([a])	([a])	([a])
Spain	597	494	524	869	404
United States	36, 499	11, 195	27, 401	24, 568	25, 833

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[a] Data not available.

[b] Only 25 kilograms exported.

[c] Exports.

[d] Data relate to the eight months, May–December, 1921.

[e] Turkey has been for many years a large producer and exporter of emery, but data of neither output nor exports are available for the years under discussion.

[f] France is a large producer and exporter of flint pebbles for grinding, but data of neither output nor exports are available.

[g] Number of stones, weight not reported.

[h] Weight not recorded, but value was as follows: 1920, $63,325; 1921, $24,524; 1922, $20,853; 1923, $22,229; 1924, $30,125.

ARTIFICIAL ABRASIVES

The artificial abrasives here considered are of three kinds—(1) metallic abrasives, (2) silicon carbide, and (3) aluminum oxide. These products are manufactured by the following concerns, some of which make more than one kind, as indicated by the numbers in parentheses:

Abrasive Co. (Abrasive Company of Canada), Bridesburg, Philadelphia, Pa., plant at Hamilton, Ontario, Canada (3).
The Carborundum Co. and Canadian Carborundum Co. (Ltd.), Niagara Falls, N. Y., and Shawinigan Falls, Quebec, Canada, plants at Niagara Falls, N. Y., Niagara Falls, Ontario, and Shawinigan Falls, Quebec (2, 3).
Exolon Co., Blasdell, N. Y., plants at Blasdell, N. Y., and Thorold, Ontario (2, 3).
General Abrasive Co. (Inc.), Niagara Falls, N. Y., plant at Niagara Falls, N. Y. (3).
Globe Steel Abrasive Co., Mansfield, Ohio, plant at Mansfield, Ohio (1).
Norton Co., Worcester, Mass., plants at Niagara Falls, N. Y., and Chippewa, Ontario (2, 3).
Pittsburgh Crushed Steel Co., Pittsburgh, Pa., plant at Pittsburgh, Pa. (1).

The figures given in the table that follows represent the crude or immediate product of the electric furnaces in which the carbide and aluminum oxide abrasives are manufactured. Much of the product there reported is subject to further manufacture before being sold. Although an undeterminable quantity is not used finally as abrasive material, the total output is here included because it is thought that the proportion used as abrasive material has not fluctuated so widely as to destroy the value of these figures for comparison with the statistics of production of natural abrasives.

Crude artificial abrasives, sold, shipped, or used, from manufacturing plants in the United States and Canada, 1916–1924

Year	Silicon carbide		Aluminum oxide		Metallic abrasives		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1916	7, 025	$707, 120	30, 708	$2, 139, 230	1, 073	$89, 559	38, 806	$2, 935, 909
1917	8, 323	1, 074, 152	48, 463	6, 969, 387	1, 125	93, 703	57, 911	8, 137, 242
1918	10, 047	1, 518, 600	35, 716	5, 741, 270	5, 150	422, 727	50, 913	7, 682, 597
1919	28, 435	3, 380, 151	19, 723	3, 811, 498	2, 360	274, 200	50, 518	7, 465, 849
1920	6, 887	1, 309, 605	32, 891	5, 956, 639	2, 659	225, 920	42, 437	7, 492, 164
1921	2, 707	475, 336	7, 325	1, 318, 771	3, 167	202, 040	13, 199	1, 996, 147
1922	16, 233	2, 022, 613	31, 898	3, 246, 714	5, 804	421, 148	53, 935	5, 690, 475
1923	21, 149	2, 786, 929	51, 391	5, 378, 926	8, 229	612, 140	80, 769	8, 777, 995
1924	17, 792	2, 161, 498	33, 708	3, 482, 577	8, 597	569, 665	60, 097	6, 213, 740

SAND AND GRAVEL

By Estelle R. Phillips

PRODUCTION

The output of sand and gravel in the United States in 1924 was larger than that reported for any preceding year and amounted to 156,230,063 short tons, valued at $97,013,115, an increase of 12 per cent in quantity and 7 per cent in value over 1923. There was a general increase in the quantity of all grades except some of the higher-priced sands, such as molding, fire or furnace, and filter sand, and in engine sand. Over three-fifths of the States showed increased output.

Although the quantity of sand produced increased 12 per cent, the value increased less than 1 per cent as the larger production was more than offset by the lower average values of all grades except filter sand and by the smaller proportion of high-priced sand. The average value of all sand was also affected by the considerable quantity of low-priced sand used for ballast and fills by the railroads.

Gravel, including that used as railroad ballast, increased 11 per cent in quantity and 14 per cent in value; gravel for building and paving increased 18 per cent in quantity and 15 per cent in value.

Sand and gravel sold or used by the producers in the United States, 1919–1924

Year	Sand		Gravel (including railroad ballast)		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1919	35, 969, 736	$26, 389, 679	34, 606, 671	$19, 561, 877	70, 576, 407	$45, 951, 556
1920	43, 776, 142	39, 198, 614	38, 265, 246	26, 462, 991	82, 041, 388	65, 661, 605
1921	38, 294, 954	29, 049, 950	41, 550, 054	27, 434, 295	79, 845, 008	56, 484, 245
1922	49, 694, 923	35, 469, 920	45, 172, 123	29, 147, 744	94, 867, 046	64, 617, 664
1923	67, 365, 271	48, 473, 565	72, 566, 882	42, 430, 089	139, 932, 153	90, 903, 654
1924	75, 572, 010	48, 844, 465	80, 658, 053	48, 168, 650	156, 230, 063	97, 013, 115
Per cent of increase over 1923	12	1	11	14	12	7

Building sand constituted 26 per cent of the country's production of sand and gravel, building gravel 20 per cent, paving gravel 18 per cent, gravel used for railroad ballast 14 per cent, and paving sand 13 per cent. Molding, glass, engine, grinding, fire or furnace, and filter sands, named in order of quantity, together equaled 7 per cent of the total, and the balance (2 per cent) consisted of miscellaneous sands, including sand used by railroads for ballast, fills, etc.

Sand and gravel sold or used by the producers in the United States, 1923–1924, by uses

Use	1923		1924	
	Short tons	Value	Short tons	Value
Sand:				
Glass	2, 034, 958	$3, 751, 778	2, 169, 899	$3, 718, 973
Molding	5, 559, 644	6, 730, 417	4, 403, 893	4, 995, 268
Building	39, 234, 762	23, 751, 244	41, 376, 425	23, 455, 393
Paving	15, 632, 419	9, 187, 468	20, 707, 875	11, 595, 499
Grinding and polishing	1, 456, 039	2, 361, 695	1, 756, 058	2, 707, 583
Fire or furnace	307, 794	445, 479	237, 143	291, 175
Engine	2, 033, 494	1, 535, 638	2, 024, 930	1, 344, 935
Filter	116, 520	139, 671	74, 828	150, 239
Other	989, 641	570, 175	2, 820, 959	585, 400
	67, 365, 271	48, 473, 565	75, 572, 010	48, 844, 465
Gravel:				
Building	24, 145, 463	18, 367, 713	30, 486, 874	22, 718, 803
Paving	26, 174, 112	17, 716, 779	28, 830, 336	18, 773, 832
Railroad ballast	22, 247, 307	6, 345, 597	21, 340, 843	6, 676, 015
	72, 566, 882	42, 430, 089	80, 658, 053	48, 168, 650
Grand total	139, 932, 153	90, 903, 654	156, 230, 063	97, 013, 115

Sand and gravel sold or used by the producers in the United States in 1923, by States and uses

State	Glass sand		Molding sand		Building sand		Paving sand		Grinding and polishing sand		Fire or furnace sand		Engine sand	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama			40,138	$19,413	658,706	$265,642	40,500	$21,750	(a)	(a)			3,000	$1,800
Arizona									(a)	(a)				
Arkansas	(a)	(a)	(a)	(a)	151,065	111,061	89,493	61,479					35,597	16,856
California	(a)	(a)	29,547	58,254	2,748,229	1,819,455	738,254	512,500	1,356	$4,409	(a)	(a)	27,890	14,152
Colorado			41	35	38,330	19,739	37,684	28,747					37,186	26,847
Connecticut			2,592	2,694	249,035	143,916	30,238	32,670					(a)	(a)
Delaware			11,513	14,081	6,260	5,001	20,676	8,814	(a)	(a)	(a)	(a)	9,708	2,427
District of Columbia					(a)	(a)	(a)	(a)						
Florida					295,145	160,012	95,900	55,250					3,120	1,440
Georgia	(a)	(a)	49,045	22,211	377,795	180,415	(a)	(a)	1,265	701			19,995	5,913
Hawaii														
Idaho					(a)	(a)	4,159	2,080					(a)	(a)
Illinois	481,328	$754,190	798,683	720,178	3,548,297	1,933,060	1,405,267	704,883	219,523	451,828	22,736	$23,750	148,870	79,143
Indiana	80,440	29,955	564,600	302,839	1,335,199	654,493	1,422,302	743,423	2,065	1,195	159	66	82,098	46,622
Iowa			35,654	40,238	1,004,261	512,413	670,181	310,750	17,225	36,288			61,680	37,627
Kansas					1,183,608	630,893	465,969	242,067	(a)	(a)			7,720	3,910
Kentucky	(a)	(a)	43,653	51,021	664,045	479,204	47,229	41,881	(a)	(a)	(a)	(a)	14,975	11,835
Louisiana					474,077	247,934	236,092	94,880					(a)	(a)
Maine					54,838	30,000	(a)	(a)	(a)	(a)			756	264
Maryland	(a)	(a)	(a)	(a)	323,770	313,008	772,915	546,538	(a)	(a)			73,937	101,317
Massachusetts	1,800	10,800	23,040	19,495	924,681	759,791	36,074	24,839	1,000	6,000	14,217	17,098	77,999	55,900
Michigan	(a)	(a)	342,936	84,965	1,748,825	1,143,971	1,069,859	530,514	198,691	39,738	(a)	(a)	1,915	790
Minnesota			24,420	24,880	787,032	449,148	413,062	217,772	5,687	13,611	1,368	1,563	23,014	11,666
Mississippi					117,701	53,878	67,485	31,170	(a)	(a)			(a)	(a)
Missouri	145,769	203,931	117,541	107,726	795,598	395,767	773,237	400,361	(a)	(a)	(a)	(a)	14,350	8,676
Montana			35	88	11,284	13,919	14,929	18,658						
Nebraska			(a)	(a)	825,803	266,303	75,686	57,422					119,196	30,135
Nevada													18,531	1,668
New Hampshire					102,062	90,541	49,000	35,000						
New Jersey	186,898	306,956	670,225	833,004	2,755,848	1,277,983	672,338	339,398	76,499	205,689	63,719	89,925	60,899	31,377
New Mexico			(a)	(a)	27,077	22,877	24,557	14,421	728	574			19,207	8,548
New York	(a)	(a)	731,896	1,212,798	5,491,031	2,661,227	850,798	640,992	(a)	(a)	15,005	10,817	111,037	57,021
North Carolina			5,400	2,700	204,051	81,048	501,844	144,397					18,137	8,816
North Dakota					(a)	(a)								
Ohio	46,189	101,362	1,053,856	1,688,452	3,114,310	2,281,151	1,389,768	911,588	(a)	(a)	72,698	150,096	125,072	88,083

[a] Included under "Undistributed."

Sand and gravel sold or used by the producers in the United States in 1923, by States and uses—Continued

State	Glass sand		Molding sand		Building sand		Paving sand		Grinding and polishing sand		Fire or furnace sand		Engine sand	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Oklahoma	32, 619	$55, 055			480, 043	$338, 710	217, 889	$127, 140					6, 655	$4, 313
Oregon					415, 772	375, 316	100, 197	89, 431					14, 713	5, 964
Pennsylvania	351, 420	724, 700	781, 389	$1, 271, 174	3, 033, 252	2, 900, 175	1, 088, 248	993, 937	715, 257	$1, 247, 416	81, 156	$114, 376	352, 895	515, 465
Rhode Island			(a)	(a)	5, 432	5, 705	(a)	(a)						
South Carolina					117, 156	46, 785	61, 211	23, 893	(a)	(a)			(a)	(a)
South Dakota					67, 027	41, 404	53, 003	26, 582					1, 600	640
Tennessee			16, 371	13, 688	780, 257	575, 031	33, 208	27, 450	19, 420	15, 000	9, 263	3, 436	35, 472	23, 121
Texas	7, 488	13, 260	1, 855	2, 978	904, 089	422, 422	143, 161	99, 511					51, 137	19, 786
Utah					112, 986	50, 068	20, 250	7, 500					18, 114	8, 200
Vermont			1, 759	1, 165	3, 023	643	3, 184	612	6, 800	1, 900				
Virginia	44, 734	97, 216	23, 931	25, 419	316, 442	176, 474	543, 438	221, 292	(a)	(a)	(a)	(a)	124, 960	67, 060
Washington			2, 656	1, 670	619, 173	310, 438	191, 107	85, 008	450	600			14, 140	6, 160
West Virginia	516, 638	1, 188, 093	24, 426	50, 774	587, 610	636, 414	222, 835	223, 124	8, 782	16, 324	1, 389	3, 072	153, 539	183, 925
Wisconsin			140, 995	124, 980	1, 499, 700	690, 263	789, 428	385, 829	(a)	(a)	2, 665	2, 665	66, 632	27, 393
Wyoming					122, 325	62, 450	21, 158	14, 516					21, 026	6, 766
Undistributed [b]	139, 635	266, 260	21, 447	33, 497	152, 512	115, 096	128, 606	87, 399	181, 291	320, 422	23, 419	28, 615	56, 722	14, 012
	2, 034, 958	3, 751, 778	5, 559, 644	6, 730, 417	39, 234, 762	23, 751, 244	15, 632, 419	9, 187, 468	1, 456, 039	2, 361, 695	307, 794	445, 479	2, 033, 494	1, 535, 638
Average value		1. 84		1. 21		0. 61		0. 59		1. 62		1. 45		0. 76

State	Filter sand		Other sands		Building gravel		Paving gravel		Railroad ballast gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	(^{a})	(^{a})			268, 283	$245, 582	341, 227	$145, 660	476, 555	$59, 639	1, 829, 559	$760, 236
Arizona					(^{a})	(^{a})	(^{a})	(^{a})			(^{a})	(^{a})
Arkansas			(^{a})	(^{a})	11, 105	9, 571	485, 386	283, 028	729, 781	266, 739	1, 572, 240	826, 304
California	2, 990	$8, 724	102, 897	$27, 407	1, 305, 363	1, 174, 770	1, 335, 827	1, 122, 975	897, 915	271, 279	7, 205, 516	5, 033, 457
Colorado			(^{a})	(^{a})	10, 713	11, 050	28, 856	31, 996	(^{a})	(^{a})	185, 994	126, 967
Connecticut			366	558	111, 068	99, 685	(^{a})	(^{a})	281, 322	21, 098	691, 039	303, 443
Delaware			4, 197	2, 254							53, 022	34, 113
District of Columbia					(^{a})	(^{a})	(^{a})	(^{a})	(^{a})	(^{a})	(^{a})	(^{a})
Florida					4, 400	3, 520	114, 680	69, 860			513, 245	290, 082
Georgia			(^{a})	(^{a})	(^{a})	(^{a})	48, 500	40, 150	(^{a})	(^{a})	595, 117	300, 621
Hawaii									(^{a})	(^{a})	(^{a})	(^{a})
Idaho					16, 560	7, 500	33, 181	14, 691	41, 522	17, 552	97, 044	43, 039
Illinois	1, 816	7, 356	186, 347	150, 306	2, 259, 994	1, 241, 865	1, 917, 260	1, 059, 312	960, 924	334, 867	11, 951, 045	7, 460, 738
Indiana	50	25	46, 842	23, 302	1, 107, 450	748, 625	2, 686, 891	1, 554, 537	3, 590, 182	885, 424	10, 918, 278	4, 990, 506
Iowa	11, 968	7, 505	31, 364	20, 455	343, 078	331, 045	837, 558	634, 020	584, 191	251, 540	3, 597, 160	2, 181, 881
Kansas	(^{a})	(^{a})	25, 090	4, 867	59, 705	21, 272	117, 320	123, 927	85, 016	10, 631	1, 950, 411	1, 039, 064
Kentucky					563, 685	375, 573	272, 458	192, 252	484, 160	111, 594	2, 101, 840	1, 279, 441
Louisiana			(^{a})	(^{a})	366, 181	285, 249	1, 277, 915	979, 493	533, 723	316, 105	2, 905, 609	1, 926, 917
Maine			15, 155	3, 545	39, 229	46, 077	30, 880	26, 509	387, 934	57, 124	531, 937	169, 905
Maryland			(^{a})	(^{a})	396, 735	537, 719	437, 882	583, 482	(^{a})	(^{a})	2, 044, 490	2, 155, 353
Massachusetts	5, 210	10, 775	3, 788	12, 301	659, 467	829, 015	60, 939	72, 824	5, 500	2, 278	1, 813, 715	1, 821, 116
Michigan			34, 426	17, 787	2, 259, 966	1, 204, 017	2, 827, 204	1, 710, 090	1, 078, 343	257, 564	9, 601, 562	5, 096, 071
Minnesota	8, 728	23, 948	46, 584	18, 276	544, 672	642, 821	569, 026	448, 923	1, 402, 879	331, 498	3, 826, 472	2, 184, 106
Mississippi					175, 602	111, 381	1, 273, 736	627, 972	1, 132, 581	402, 282	2, 772, 149	1, 229, 809
Missouri					418, 748	180, 794	719, 599	379, 980	626, 511	249, 254	3, 719, 243	2, 007, 529
Montana					16, 490	12, 694	35, 636	40, 685	286, 929	70, 013	365, 303	156, 057
Nebraska	(^{a})	(^{a})	7, 462	2, 371	310, 192	207, 256	493, 412	335, 327	77, 535	16, 210	1, 930, 104	921, 433
Nevada			4, 633	417					246, 160	54, 853	269, 324	56, 938
New Hampshire					89, 420	118, 516	245, 000	175, 000	19, 581	4, 797	505, 063	423, 854
New Jersey	33, 740	54, 635	74, 660	85, 370	1, 366, 212	1, 065, 264	140, 166	92, 254			6, 101, 204	4, 381, 855
New Mexico	140	200	2, 500	475	35, 431	31, 625	42, 773	32, 056	(^{a})	(^{a})	464, 410	239, 470
New York	25, 227	12, 651	47, 439	36, 903	2, 862, 087	2, 165, 923	435, 296	394, 270	141, 248	83, 902	10, 730, 225	7, 291, 076
North Carolina			13, 000	9, 122	301, 711	367, 586	913, 671	781, 359	95, 103	19, 511	2, 052, 917	1, 414, 539
North Dakota									(^{a})	(^{a})	(^{a})	(^{a})
Ohio	(^{a})	(^{a})	4, 005	7, 544	1, 340, 000	1, 000, 870	1, 317, 296	868, 394	1, 620, 590	575, 466	10, 126, 977	7, 863, 375

[a] Included under "Undistributed."

[b] Includes items entered as "(^{a}.)"

Sand and gravel sold or used by the producers in the United States in 1923, by States and uses—Continued

State	Filter sand		Other sands		Building gravel		Paving gravel		Railroad ballast gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Oklahoma	140	$100	16, 679	$5, 348	228, 078	$129, 062	336, 151	$270, 703	85, 931	$44, 030	1, 404, 185	$974, 461
Oregon			62, 882	19, 350	549, 316	464, 414	387, 694	311, 502	171, 865	54, 506	1, 702, 439	1, 320, 483
Pennsylvania	2, 705	2, 003	32, 044	22, 397	1, 826, 040	1, 388, 599	831, 940	717, 246	124, 946	46, 531	9, 221, 292	9, 944, 019
Rhode Island					600	700	405	750	47, 250	3, 544	69, 714	36, 373
South Carolina	(a)	(a)	(a)	(a)	102, 956	141, 097	92, 230	37, 263	136, 112	63, 271	581, 048	336, 109
South Dakota	100	250	2, 100	1, 000	20, 596	20, 295	51, 881	43, 206	108, 461	23, 537	304, 768	156, 914
Tennessee			8, 742	6, 259	348, 149	269, 421	528, 596	290, 950	88, 859	28, 728	1, 868, 337	1, 253, 084
Texas	503	614	27, 304	12, 496	982, 172	778, 020	1, 117, 527	644, 282	1, 824, 365	577, 625	5, 059, 601	2, 570, 994
Utah			398	25	137, 683	55, 877	214, 091	27, 612	708, 555	141, 525	1, 212, 077	290, 807
Vermont			(a)	(a)	5, 750	1, 473	2, 025	300	(a)	(a)	55, 551	18, 793
Virginia			(a)	(a)	494, 647	508, 390	500, 021	498, 460	90, 338	44, 406	2, 193, 861	1, 665, 439
Washington					787, 043	377, 615	735, 715	311, 185	1, 438, 825	270, 330	3, 789, 109	1, 363, 006
West Virginia			6, 250	7, 093	476, 539	511, 830	415, 592	370, 399	24, 000	9, 600	2, 437, 600	3, 200, 648
Wisconsin	(a)	(a)	43, 100	14, 650	682, 919	378, 241	1, 559, 302	1, 094, 062	223, 367	37, 916	5, 021, 608	2, 793, 999
Wyoming					101, 304	77, 089	205, 057	93, 105	906, 401	149, 985	1, 377, 271	403, 911
Undistributed [b]	23, 203	10, 885	139, 387	58, 297	158, 124	188, 725	156, 310	184, 728	481, 847	178, 843	611, 478	565, 319
	116, 520	139, 671	989, 641	570, 175	24, 145, 463	18, 367, 713	26, 174, 112	17, 716, 779	22, 247, 307	6, 345, 597	139, 932, 153	90, 903, 654
Average value		1. 20		0. 58		0. 76		0. 68		0. 29		0. 65

[a] Included under "Undistributed."

[b] Includes items entered as "(a)."

Sand and gravel sold or used by the producers in the United States in 1924, by States and uses

State	Glass sand		Molding sand		Building sand		Paving sand		Grinding and polishing sand		Fire or furnace sand		Engine sand	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama			19,205	$19,325	391,327	$128,100	247,495	$122,682	([a])	([a])	([a])	([a])	([a])	([a])
Arizona					([a])	([a])							([a])	([a])
Arkansas	([a])	([a])	([a])	([a])	52,576	41,666	188,065	128,565					([a])	([a])
California	([a])	([a])	26,083	50,935	3,536,109	1,999,208	1,200,532	691,826	([a])	([a])	([a])	([a])	27,714	$13,978
Colorado			([a])	([a])	309,385	107,952	161,381	105,571					([a])	([a])
Connecticut			1,669	1,434	508,579	385,343	([a])	([a])	([a])	([a])			([a])	([a])
Delaware			12,511	11,268	13,436	11,004	([a])	([a])					([a])	([a])
District of Columbia					([a])	([a])	([a])	([a])						
Florida					376,595	215,461	169,584	55,132					([a])	([a])
Georgia	14,100	$8,545	15,852	3,181	286,523	99,618	420,728	90,364	3,880	$1,374	([a])	([a])	18,368	5,840
Hawaii					([a])	([a])	([a])	([a])						
Idaho					3,000	2,700	([a])	([a])					270	250
Illinois	601,509	640,655	759,248	637,961	3,255,710	1,595,084	1,949,338	992,838	271,254	480,184	9,148	$16,634	160,387	82,110
Indiana	([a])	([a])	573,979	252,674	1,798,633	634,260	2,444,949	970,403	([a])	([a])	([a])	([a])	124,534	35,071
Iowa			([a])	([a])	653,031	317,068	575,835	234,966	([a])	([a])			47,607	24,661
Kansas					1,078,101	709,829	316,363	190,633					18,549	8,775
Kentucky	([a])	([a])	36,792	46,295	572,483	390,922	151,846	103,533	([a])	([a])	([a])	([a])	22,011	24,902
Louisiana	([a])	([a])			363,606	263,463	([a])	([a])					([a])	([a])
Maine					17,866	9,521	15,552	10,418	([a])	([a])			([a])	([a])
Maryland	([a])	([a])	([a])	([a])	1,195,671	775,896	179,497	150,659					36,265	81,165
Massachusetts	([a])	([a])	34,447	22,699	1,249,050	951,072	99,900	75,897	8,931	16,748	([a])	([a])	65,455	54,288
Michigan			236,766	139,648	2,049,487	907,327	1,620,066	689,438	248,635	77,226	([a])	([a])	2,307	1,159
Minnesota			12,803	15,029	770,564	377,296	326,278	165,980	3,804	9,187			39,931	17,367
Mississippi			720	540	181,144	79,259	100,162	46,997					22,912	5,943
Missouri	161,604	225,963	73,155	49,733	832,536	467,874	616,278	285,483	([a])	([a])			([a])	([a])
Montana					([a])	([a])	10,654	6,398						
Nebraska			4,000	6,000	694,231	233,300	113,284	67,037					122,658	31,976
Nevada													22,942	2,089
New Hampshire					83,567	66,098	75,248	60,249						
New Jersey	184,831	298,297	424,470	580,856	1,385,392	815,315	937,966	533,689	101,056	250,698	29,011	42,612	51,724	24,358

[a] Included under "Undistributed."

Sand and gravel sold or used by the producers in the United States in 1924, by States and uses—Continued

State	Glass sand		Molding sand		Building sand		Paving sand		Grinding and polishing sand		Fire or furnace sand		Engine sand	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
New Mexico			83	$75	(a)	(a)	(a)	(a)	550	$750			22,148	$9,234
New York	(a)	(a)	607,089	1,040,735	6,837,896	$3,248,302	1,704,351	$1,082,249	50	250	5,743	$4,481	115,756	70,817
North Carolina	(a)	(a)	(a)	(a)	40,250	18,142	403,052	168,156					18,663	7,774
North Dakota					(a)	(a)	(a)	(a)						
Ohio	47,154	$109,539	917,733	1,206,501	2,697,376	1,866,432	1,450,374	995,410	72,579	259,478	39,106	87,995	83,711	47,895
Oklahoma	28,871	50,523			506,738	212,088	560,555	232,321	11,682	7,828			25,636	15,710
Oregon					348,203	334,916	103,010	78,033					10,592	3,284
Pennsylvania	439,723	932,572	477,087	725,981	4,225,100	3,352,585	1,502,227	1,459,762	651,956	1,047,186	23,649	42,911	343,520	379,274
Rhode Island			(a)	(a)	(a)	(a)	(a)	(a)						
South Carolina					79,135	30,013	252,052	99,093					(a)	(a)
South Dakota					41,417	32,010	24,160	17,189					(a)	(a)
Tennessee			18,468	18,909	694,657	616,661	167,942	111,176	74,670	65,767	2,618	2,218	33,782	27,342
Texas	(a)	(a)	(a)	(a)	1,010,119	447,162	230,125	137,284	100	600	7,450	4,600	46,225	18,465
Utah					34,755	14,376	34,088	14,016	(a)	(a)			(a)	(a)
Vermont			(a)	(a)	2,433	2,338	4,600	4,885	(a)	(a)			1,600	850
Virginia	55,003	124,597	12,082	13,643	498,815	293,001	281,828	127,154	(a)	(a)	(a)	(a)	121,151	53,760
Washington			(a)	(a)	488,231	246,982	500,957	277,267					41,966	14,990
West Virginia	466,125	1,092,524	(a)	(a)	326,816	397,195	378,033	366,680	(a)	(a)	4,259	6,187	162,407	179,801
Wisconsin			81,337	64,803	1,703,946	577,232	709,877	307,183	17,200	36,750	5,000	7,500	60,274	26,471
Wyoming					(a)	(a)	29,048	21,654					(a)	(a)
Undistributed [b]	170,979	235,758	58,314	87,043	181,936	181,322	450,595	317,229	289,711	453,557	111,159	76,037	153,865	75,336
	2,169,899	3,718,973	4,403,893	4,995,268	41,376,425	23,455,393	20,707,875	11,595,499	1,756,058	2,707,588	237,143	291,175	2,024,930	1,344,935
Average value		1.71		1.13		0.57		0.56		1.54		1.23		0.66

[a] Included under "Undistributed."

[b] Includes items entered as "(a)."

State	Filter sand		Other sands		Building gravel		Paving gravel		Railroad ballast gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	(a)	(a)	(a)	(a)	349,475	$229,591	511,914	$315,066	641,579	$68,051	2,443,753	$917,914
Arizona					(a)	(a)			(a)	(a)	69,225	17,752
Arkansas			(a)	(a)	68,458	51,817	669,185	401,845	1,918,657	867,119	2,944,022	1,560,379
California	(a)	(a)	16,753	$8,634	3,433,634	2,127,865	1,731,708	1,382,683	1,129,369	331,606	11,132,930	6,653,536
Colorado			(a)	(a)	116,673	85,371	301,162	424,842	269,169	43,145	1,219,526	799,215
Connecticut			(a)	(a)	389,916	408,017	62,615	42,355			1,191,421	1,175,757
Delaware	(a)	(a)	(a)	(a)	(a)	(a)					41,499	33,271
District of Columbia					(a)	(a)					(a)	(a)
Florida					(a)	(a)	(a)	(a)			645,917	375,853
Georgia			(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	874,527	242,754
Hawaii							(a)	(a)			(a)	(a)
Idaho					(a)	(a)	30,608	10,416	(a)	(a)	113,028	33,734
Illinois	(a)	(a)	(a)	(a)	2,382,599	1,324,295	1,841,225	1,086,104	1,025,638	367,292	12,313,979	7,281,766
Indiana			(a)	(a)	1,144,447	649,851	3,423,406	1,649,411	2,011,216	711,004	12,933,373	5,070,339
Iowa	(a)	(a)	10,879	3,954	311,558	289,584	563,776	483,003	226,862	62,699	2,427,626	1,473,066
Kansas	4,200	$2,250	4,886	1,064	297,463	150,755	162,398	159,508	1,008	202	1,882,968	1,223,016
Kentucky			(a)	(a)	626,988	396,867	635,245	403,363	1,379,182	239,189	3,442,457	1,629,973
Louisiana			(a)	(a)	570,052	501,205	1,350,705	961,896	589,649	456,077	3,132,447	2,287,495
Maine					24,245	32,984	39,270	43,581	201,542	47,718	303,398	149,454
Maryland			(a)	(a)	916,329	1,223,534	32,387	26,633	1,000	200	2,418,137	2,368,813
Massachusetts	(a)	(a)	1,357	6,705	749,003	913,280	600,420	391,117	(a)	(a)	2,904,911	2,496,148
Michigan			(a)	(a)	3,339,045	2,269,142	3,228,893	1,712,910	625,635	170,894	11,381,084	5,975,757
Minnesota	5,557	19,450	103,751	8,077	623,791	717,482	485,329	351,296	628,199	201,865	3,000,007	1,883,029
Mississippi			100	500	126,904	88,855	1,269,132	620,514	741,837	291,680	2,442,911	1,134,288
Missouri			(a)	(a)	852,538	498,086	597,304	277,810	817,745	145,440	4,081,200	2,053,436
Montana			(a)	(a)	20,648	15,517	23,866	15,783	500,997	127,178	597,161	172,151
Nebraska			26,943	8,517	712,860	480,166	340,172	233,568	84,252	38,935	2,098,400	1,099,499
Nevada					170	53			719,696	150,503	742,808	152,645
New Hampshire					22,697	44,313	303,509	244,974	10,581	380	495,602	416,014
New Jersey	21,065	59,857	9,999	9,500	594,592	523,486	228,255	207,096			3,968,361	3,345,764
New Mexico	110	150			40,149	33,397	112,426	84,809	300,733	93,690	526,787	267,110
New York	14,792	11,758	(a)	(a)	2,771,860	2,108,703	1,255,448	962,790	70,246	40,100	13,397,540	8,583,193
North Carolina			2,250	2,800	221,189	270,081	383,113	406,295	(a)	(a)	1,098,192	889,050
North Dakota					(a)	(a)	(a)	(a)	249,116	27,214	312,966	86,366
Ohio	(a)	(a)	(a)	(a)	2,117,685	1,296,511	1,538,768	1,010,147	1,378,875	549,175	10,379,361	7,441,659

[a] Included under "Undistributed."

Sand and gravel sold or used by the producers in the United States in 1924, by States and uses—Continued

State	Filter sand		Other sands		Building gravel		Paving gravel		Railroad ballast gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Oklahoma			8, 702	$1, 273	134, 679	$75, 240	433, 281	$239, 555	136, 124	$59, 917	1, 846, 268	$894, 455
Oregon			27, 870	5, 098	568, 801	400, 699	913, 144	672, 282	266, 436	120, 802	2, 238, 056	1, 615, 114
Pennsylvania	(a)	(a)	(a)	(a)	2, 450, 313	1, 952, 139	1, 086, 860	945, 074	63, 186	24, 590	11, 315, 209	10, 927, 752
Rhode Island					(a)	(a)	(a)	(a)			46, 378	35, 932
South Carolina	(a)	(a)	(a)	(a)	(a)	(a)	114, 032	110, 033	(a)	(a)	743, 746	364, 977
South Dakota	(a)	(a)	(a)	(a)	14, 721	13, 123	(a)	(a)	208, 991	25, 096	323, 303	113, 602
Tennessee					358, 264	322, 656	449, 770	267, 824	142, 138	51, 047	1, 942, 309	1, 483, 600
Texas	(a)	(a)	234, 380	64, 710	1, 347, 598	1, 025, 232	988, 202	579, 790	1, 790, 952	540, 726	5, 674, 651	2, 850, 955
Utah			219, 035	45, 315	53, 289	21, 936	(a)	(a)	248, 893	30, 129	659, 588	154, 793
Vermont			12, 500	4, 000	3, 552	4, 044	2, 633	1, 835	41, 900	13, 125	131, 453	34, 795
Virginia			(a)	(a)	481, 305	568, 726	305, 881	294, 939	(a)	(a)	1, 897, 909	1, 534, 235
Washington			(a)	(a)	753, 295	399, 533	449, 067	214, 114	1, 227, 696	240, 158	3, 464, 557	1, 398, 506
West Virginia					244, 133	257, 458	504, 036	512, 834	67, 231	45, 803	2, 168, 045	2, 888, 833
Wisconsin	6, 500	$14, 000	321	201	960, 435	602, 915	1, 568, 459	825, 304	600, 607	241, 116	5, 713, 956	2, 703, 475
Wyoming					15, 249	20, 675	51, 006	47, 393	501, 568	70, 490	615, 163	173, 886
Undistributed[b]	22, 604	42, 774	2, 141, 233	415, 052	276, 272	323, 619	241, 726	153, 040	522, 338	181, 660	491, 948	548, 009
	[c] 74, 828	[c] 150, 239	[d] 2, 820, 959	[d] 585, 400	30, 486, 874	22, 718, 803	28, 830, 336	18, 773, 832	21, 340, 843	6, 676, 015	156, 230, 063	97, 013, 115
Average value		2. 01		0. 21		0. 75		0. 65		0. 31		0. 62

[a] Included under "Undistributed."
[b] Includes items entered as "(a)."
[c] Includes a small quantity of filter gravel.
[d] Includes 878,597 tons of sand used as railroad ballast, valued at $118,893; also sand used for railroad fills, bank widening, and for other purposes

PRICES

The only figures relating to prices of sand and gravel compiled by the Bureau of Mines are those shown in the following table. They represent the total average values of the different grades of sand and gravel. These values must not be considered as prices, such as may be found quoted in the trade journals, but they indicate the trend of price changes during these years.

The average value for sand and gravel in 1924 was 62 cents as compared with 65 cents in 1923. The value increased each year from 30 cents in 1915 to 80 cents in 1920, fell to 71 cents in 1921, and has decreased 3 cents each year since.

Although some States showed increases in average values of the different grades of sand and gravel, the United States totals showed a decrease for all grades except for filter sand and for gravel used as railroad ballast.

Average value per short ton of sand and gravel sold or used by the producers in the United States, 1917–1924

[Based on amounts received for sales f. o. b. pits or nearest shipping points]

Kind	1917	1918	1919	1920	1921	1922	1923	1924
Glass sand	$1.38	$1.94	$1.97	$2.19	$1.81	$1.62	$1.84	$1.71
Molding sand	.92	1.04	1.10	1.46	1.29	1.17	1.21	1.13
Building sand	.39	.50	.56	.68	.65	.60	.61	.57
Paving sand	.41	.54	.66	.68	.63	.61	.59	.56
Grinding and polishing sand	1.04	1.60	1.34	1.80	1.61	1.46	1.62	1.54
Fire or furnace sand	1.15	1.48	1.23	1.81	1.56	1.42	1.45	1.23
Engine sand	.59	.76	.77	.82	.86	.76	.76	.66
Filter sand	.76	1.47	1.48	1.27	1.11	1.99	1.20	2.01
Railroad ballast gravel	.17	.22	.30	.32	.33	.36	.29	.31
Gravel (exclusive of railroad ballast)	.46	.57	.66	.81	.75	.72	.72	.70
All sand and gravel	.46	.61	.65	.80	.71	.68	.65	.62

GLASS SAND

The quantity of glass sand increased about 7 per cent but the total value decreased slightly. Of States that reported production, Illinois, West Virginia, Pennsylvania, New Jersey, and Missouri, named in order of quantity, produced 85 per cent of the total.

Glass sand sold or used by the producers in the United States, 1917–1924

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average			Total	Average
1917	1,942,675	$2,685,014	$1.38	1921	1,280,359	$2,314,314	$1.81
1918	2,172,887	4,209,728	1.94	1922	1,768,549	2,866,366	1.62
1919	1,827,409	3,593,371	1.97	1923	2,034,958	3,751,778	1.84
1920	2,165,926	4,748,690	2.19	1924	2,169,899	3,718,973	1.71

Deposits of glass sand reported as being worked in 1924 are as follows:

Arkansas: Izard County—Guion, Silica Products Co. (Inc.).
California: Monterey County—Pacific Grove, Del Monte Properties Co.

Georgia:
  Talbot County—Junction City, Moore Sand Co.
  Telfair County—Lumber City, Vaughn Sand Co.
  Wheeler County—Lumber City, Hinson Sand Mines.
Illinois:
  Kendall County—Millington, Ballou White Sand Co.
  La Salle County—
    Ottawa, Crescent Silica Co. (address, Chicago); Ottawa Silica Co.; Standard Silica Co. (address, Chicago); United States Silica Co. (address, Chicago).
    Utica, E. J. Reynolds Sand Co.
    Wedron, Wedron Silica Co. (address, Chicago).
Indiana: La Porte County—Michigan City, Hoosier Slide Sand Co.
Kentucky: Carter County—Lawton, Interstate Window Glass Co.
Louisiana: Allen County—Le Blanc, Opelousas Stone Brick Co.
Maryland: Washington County—Hancock, Maryland Glass Sand Co. (Inc.) (address, Hagerstown).
Massachusetts: Berkshire County—Cheshire, Berkshire Glass Sand Co. (address, Farnams).
Missouri:
  Franklin County—Gray Summit, Tavern Rock Sand Co. (address, St. Louis).
  Jefferson County—Crystal City, Pittsburgh Plate Glass Co. (address, Pittsburgh, Pa.).
  St. Charles County—Klondike, Tavern Rock Sand Co. (address, St. Louis).
  St. Louis County—Pacific, Walter W. Goran; Tavern Rock Sand Co. (address, St. Louis).
New Jersey:
  Camden County—
    Penbryn, Reading Sand Co. (address, Bridgeton).
    Williamstown Junction, Bridgeton Sand Co. (address, Bridgeton).
  Cumberland County—
    Cedarville, Crystal Sand Co. (address, Bridgeton).
    Millville, Tavern Rock Sand Co. (address, St. Louis, Mo.).
    South Vineland, Crystal Sand Co. (address, Bridgeton); Whitall Tatum Co. (address, Millville).
  Middlesex County—South River, Marcus S. Wright.
New York: Oswego County—Cleveland, Oneida Lake Sand Co.
North Carolina: Scotland County—Gibson, Gale Sand Co.
Ohio:
  Fairfield County—Rushville, Ohio Flint & Glass Sand Co. (address, Zanesville).
  Knox County—Howard, Knox White Sand Co.
  Licking County—Toboso, Edward H. Everett Co. (address, Newark).
  Mahoning County—Austintown, National Sand & Stone Co. (address, Niles).
  Perry County—Chalfants, Central Silica Co. (address, Zanesville).
Oklahoma: Pontotoc County—Roff, Mid-Continent Glass Sand Co.
Pennsylvania:
  Elk County—
    Daguscahonda, Silicon Products Co. (address, Ridgway).
    Garovi, Ridgway Croyland Silica Sand Co. (address, Ridgway).
  Fayette County—
    Dunbar, American Manganese Manufacturing Co.; Yough Sand & Stone Co.
    Masontown, Sterling Sand Co.
  Franklin County—Pond Bank, Mont Alto Sand Co. (address, Waynesboro).
  Huntingdon County—Mapleton Depot, Juniata White Sand Co. (address, Baltimore, Md.); Pennsylvania Glass Sand Co. (address, Lewistown); Pittsburgh White Sand Co. (address, Pittsburgh).
  Mifflin County—
    McVeytown, Mifflin Sand Co. (address, Lewistown).
    Newton Hamilton, Crystal Sand Co. (address, Latrobe).
    Vineyard, Pennsylvania Glass Sand Co. (address, Lewistown).
  Venango County—Kennerdell, Pittsburgh Plate Glass Co. (address, Pittsburgh).
Texas:
  Atascosa County—Tarbutton, Osburn Sand Co. (address, Poteet).
  Coleman County—Santa Anna, Parker Silica Sand Co.

Virginia:
  Rockbridge County—Goshen, N. Q. Speer Sand Corporation.
  Scott County—
    Cassard, Pennsylvania Glass Sand Co. (address, Lewistown, Pa.).
    Mendota, Clinch Mountain Silica Sand Corporation.
West Virginia:
  Fayette County—Thayer, Sun Sand Co. (address, Charleston).
  Monongalia County—Sturgisson, Decker's Creek Stone & Sand Co. (address, Morgantown); Silica Glass Sand Co. (address, Morgantown).
  Morgan County—
    Berkeley Springs, Berkeley Glass Sand Co.; E. F. Millard Sand Works; Speer White Sand Co.; West Virginia & Pittsburgh Sand Co.
    Brosius, Pennsylvania Glass Sand Co. (address, Lewistown, Pa.).
    Great Cacapon, Hazel Atlas Glass Co. (address, Wheeling).
  Upshur County—Imperial, Superior Glass Sand Co. (address, Clarksburg).

MOLDING SAND

In 1924 there was a decrease of 21 per cent in the quantity of molding sand, following an increase of 45 per cent in 1923, when quantity reached its highest mark. Of the 32 States reporting production, the leading States, named in the order of quantity, were Ohio, Illinois, New York, Indiana, Pennsylvania, New Jersey, and Michigan, and these States supplied 91 per cent of the total.

Molding sand sold or used by the producers in the United States, 1917–1924

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average			Total	Average
1917	4,660,968	$4,303,809	$0.92	1921	1,906,977	$2,451,966	$1.29
1918	4,910,178	5,121,865	1.04	1922	3,839,116	4,478,405	1.17
1919	3,774,612	4,153,990	1.10	1923	5,559,644	6,730,417	1.21
1920	5,128,075	7,504,759	1.46	1924	4,403,893	4,995,268	1.13

IMPORTS AND EXPORTS [1]

There was an increase of 47 per cent in the quantity of sand and gravel imported in 1924. Canada was the source of 89 per cent of the total.

Sand and gravel imported for consumption in the United States, 1923–24

	1923		1924	
	Short tons	Value	Short tons	Value
Glass sand	2,309	$3,008	6,479	$1,961
Other sand	276,493	157,125	246,345	123,099
Gravel	198,960	99,687	448,586	155,146
	477,762	259,820	701,410	280,206

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[1] Statistics of imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Sand and gravel imported into the United States, 1923–24, by countries

[General imports]

Country	1923		1924	
	Short tons	Value	Short tons	Value
North America:				
Canada	399,252	$174,187	622,970	$221,627
Mexico	206	80	541	338
South America:				
Brazil and Colombia	326	8,450		
Europe:				
Austria	256	1,109		
Belgium	73,757	60,238	76,251	42,890
Czechoslovakia	123	44		
England	1,256	4,897	465	3,650
France	717	4,108	660	4,457
Germany	1,746	5,903	36	726
Ireland			17	71
Italy			17	775
Netherlands	112	600	224	1,199
Norway			1	3
Sweden			4	15
Asia:				
China	1	10		
Hongkong			(a)	3
India (British)			224	4,452
Japan	10	191		
Palestine and Syria	(a)	3		
	477,762	259,820	701,410	280,206

[a] Quantity not shown.

Sand and gravel exported from the United States, 1917–1924

Year	Short tons	Value	Year	Short tons	Value
1917	(a)	$494,251	1921	(a)	$379,982
1918	(a)	619,414	1922	356,520	400,199
1919	(a)	382,070	1923	551,233	598,633
1920	(a)	669,945	1924	314,140	401,662

[a] Quantity not recorded prior to 1922.

STONE

By G. F. LOUGHLIN and A. T. COONS

SUMMARY OF PRODUCTION

The aggregate sales of stone by quarrymen in the United States in 1924 were practically the same as in 1923. There was a decrease of one-tenth of 1 per cent in quantity and an increase of 1.5 per cent in value. Basalt and miscellaneous varieties of stone used chiefly as crushed stone for construction, road metal, and railroad ballast increased, but granite, sandstone, marble, and limestone, which have more various uses, decreased. The total value of all varieties except granite increased.

The tables of this report give the quantities sold or used, and the values f. o. b. at quarries and mills as far as these are obtainable. Stone quarried and used by the producer is considered as sold and is included in the figures given. This report does not, however, include the stone manufactured into abrasives (grindstones, etc.), glass sand, lime, or cement and reported in terms of finished product. These products are treated in the chapters on abrasives, sand and gravel, lime, and cement.

Stone sold or used by the producers in the United States, 1922–1924, by kinds

[Quantities approximate]

Year	Granite		Basalt and related rocks (trap rock)		Sandstone		Marble	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1922	5,913,120	$21,125,869	10,032,900	$12,600,611	3,388,130	$7,521,044	427,870	$10,534,671
1923	[a]7,300,130	[a]29,704,796	10,674,470	13,539,648	4,349,270	9,174,706	562,560	12,863,974
1924	6,883,860	28,772,161	11,671,500	14,679,523	3,894,690	10,142,099	516,000	13,302,235
Percentage of increase or decrease in 1924	−6	−3	+9	+8	−10	+10	−8	+3

Year	Limestone		Miscellaneous [b]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1922	58,928,660	$68,397,927	1,520,880	$1,886,806	80,211,560	$122,066,928
1923	76,701,360	89,620,007	3,730,870	4,567,110	[a]103,318,660	[a]159,470,241
1924	75,894,430	89,868,956	4,323,640	5,105,139	103,184,120	161,870,113
Percentage of increase or decrease in 1924	−1	+0.3	+16	+12	−0.1	+1.5

[a] Revised figures.

[b] Includes mica schist, conglomerate, argillite, various, light-colored volcanic rocks, serpentine not used as marble, and such other stone as can not be properly classed in any of the main groups.

The demand for stone in 1924 varied with the use of the stone. Demand for building stone, crushed stone, curbstone, and flagstone was fairly active, but the demand for monumental stone, paving blocks, fluxing stone, and stone used by some of the manufacturing industries was less than in 1923. Conditions at the quarries were about the same in the two years. There was no serious labor trouble. Operating costs in 1924 were about the same or a trifle higher than in 1923. Prices showed a tendency to increase for some stone products, and to decrease for others, and the average value per short ton for the total output in 1924 ($1.57) was 3 cents more than for 1923. Competition was keen, and continued improvement in quarry methods and methods of marketing were sought and applied to keep down costs and prices.

Stone sold or used by the producers in the United States, 1923–24, by uses

Use	1923		1924	
	Quantity	Value	Quantity	Value
Building stone__________cubic feet__	[a] 26, 417, 020	[a]$32, 022, 717	28, 352, 380	$33, 175, 656
Approximate equivalent in short tons__________	[a] 2, 058, 930	__________	2, 211, 750	__________
Monumental stone__________cubic feet__	[a] 5, 100, 350	[a]16, 130, 230	4, 750, 980	15, 305, 386
Approximate equivalent in short tons__________	[a] 423, 610	__________	393, 550	__________
Paving blocks__________number__	45, 866, 480	4, 003, 490	41, 037, 570	3, 578, 676
Approximate equivalent in short tons__________	462, 210	__________	375, 860	__________
Curbing__________cubic feet__	3, 227, 810	2, 936, 313	3, 815, 850	3, 468, 821
Approximate equivalent in short tons__________	252, 300	__________	296, 070	__________
Flagging__________cubic feet__	607, 600	422, 059	810, 440	560, 156
Approximate equivalent in short tons__________	43, 860	__________	59, 840	__________
Rubble__________short tons__	882, 010	1, 298, 050	864, 790	1, 160, 258
Riprap__________do____	3, 185, 900	2, 989, 068	3, 265, 130	3, 634, 439
Crushed stone__________do____	62, 322, 710	67, 928, 651	68, 198, 440	73, 861, 576
Furnace flux (limestone and marble)__________do____	25, 602, 450	20, 377, 138	19, 690, 490	15, 839, 868
Refractory stone (ganister, mica schist, and dolomite)__________short tons__	1, 151, 900	1, 572, 794	1, 093, 940	1, 389, 413
Manufacturing industries (limestone and marble)__________short tons__	4, 668, 470	4, 224, 230	4, 733, 770	4, 410, 559
Other uses[b]__________do____	2, 264, 310	5, 565, 501	2, 000, 490	5, 485, 305
Total (quantities approximate, in short tons)__	[a]103, 318, 660	[a]159, 470, 241	103, 184, 120	161, 870, 113

[a] Revised figures.
[b] Chiefly agricultural limestone. (See pp. 284, 288.)

Building stone.—Sales of building stone increased 7 per cent in quantity and 4 per cent in value in 1924. The largest increase (31 per cent) was in the quantity of granite sold. Total sales of all other varieties except limestone and "Miscellaneous" also increased. Sales of stone for rough construction, and for rough and cut architectural stone increased and sales of sawed stone decreased. The average value per cubic foot of all building stone was lower and the average value of the stone sold rough for architectural construction was higher than in 1923. The sales of building stone by kinds as reported in 1923 and 1924 were as follows:

Building stone sold or used by the producers in the United States, 1923–24, by kinds

Kind	Rough				Finished				Total	
	Constructional		Architectural		Sawed [a]		Cut [a]			
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value
1923										
Granite	4,064,460	$768,412	496,940	$451,388	[a] 138,980	$307,537	[a] [b] 543,870	[a] [b] $3,484,025	[b] 5,244,250	[b] $5,011,362
Sandstone	1,260,510	201,091	700,240	375,271	1,096,390	1,156,313	172,310	397,877	3,229,450	2,130,552
Limestone	2,415,300	238,805	5,031,840	3,184,932	4,925,510	5,676,658	2,267,300	7,120,700	14,639,950	16,221,095
Marble			847,380	1,894,033	711,820	1,476,525	869,480	5,090,735	2,428,680	8,461,293
Basalt	463,380	57,664							463,380	57,664
Miscellaneous	166,100	45,606	228,000	70,145			17,210	25,000	411,310	140,751
	8,369,750	1,311,578	7,304,400	5,975,769	6,872,700	8,617,033	[b] 3,870,170	[b] 16,118,337	[b] 26,417,020	[b] 32,022,717
Average value		$0.16		$0.82		$1.25		$4.16		$1.21
1924										
Granite	5,183,660	849,980	860,300	772,953	[a] 301,820	[a] 617,527	[a] 498,770	[a] 3,423,316	6,844,550	5,663,776
Sandstone	1,424,640	155,802	568,560	322,877	1,082,680	1,193,709	474,650	1,058,063	3,550,530	2,730,451
Limestone	2,691,870	304,911	5,012,520	3,231,613	4,106,510	4,447,016	2,645,420	7,822,140	14,456,320	15,805,680
Marble			946,500	2,080,559	719,880	1,378,838	939,800	5,339,822	2,606,180	8,799,219
Basalt	595,320	77,145							595,320	77,145
Miscellaneous	299,480	99,385							299,480	99,385
	10,194,970	1,487,223	7,387,880	6,408,002	6,210,890	7,637,090	4,558,640	17,643,341	28,352,380	33,175,656
Average value		$0.15		$0.87		$1.23		$3.87		$1.17

[a] For granite, sawed stone corresponds to dressed stone for construction work (walls, foundations, bridges) and cut stone to architectural stone for high-class buildings.
[b] Revised figures.

Monumental stone.—Stone sold for monumental and memorial work in 1924 decreased 7 per cent in quantity and 5 per cent in value. Granite sold for this purpose showed a decrease of 11 per cent in quantity. Of the chief States producing monumental granite Georgia, Massachusetts, Minnesota, Vermont, and Wisconsin reported decreased sales. For New Hampshire the sales were practically the same as in 1923; for Maine and Rhode Island they were larger. North Carolina and South Carolina also showed smaller sales of granite for monumental work. Importation of low-priced foreign granite for small-sized monuments is one reason given for the decline in sales of domestic granite for monumental work. Marble sold as monumental and memorial stone increased 7 per cent in quantity.

Paving blocks, curbstone, flagstone, and crushed stone.—Street and road material in general showed increased sales in 1924, although sales of paving blocks decreased 11 per cent in quantity. Stone sold for curbing increased 18 per cent in quantity and stone sold for flagging increased 33 per cent. The increased use of flagstones was for yard and garden walks, in competition with concrete and gravel. The total quantity of crushed stone sold increased 9 per cent over 1923. Crushed stone sold for concrete and road work increased 13 per cent in quantity and crushed stone reported as railroad ballast decreased 7 per cent.

Fluxing stone.—Stone sold to blast furnaces, open-hearth steel works, smelters, and other metallurgic plants for fluxing decreased 23 per cent in quantity.

Refractory stone.—Stone reported as sold for refractory use, which includes dolomite, quartzite, and mica schist, decreased 5 per cent, and reflects, as does the decrease in fluxing stone, the lessened activities of metallurgic furnaces in 1924. The sales of raw dolomite reported as sold for the manufacture of refractories in 1924 increased. Exact figures for raw dolomite for this purpose are hard to get because sale to furnaces and smelters tends to cause it to be reported as fluxing stone. Operators who both quarry and dead-burn or sinter dolomite reported 328,659 short tons of the sintered material—a decrease of 8 per cent. Quartzite (ganister) used in the manufacture of refractory brick, for furnace lining, and for the manufacture of ferrosilicon decreased 17 per cent in quantity in 1924, and mica schist used as furnace and kiln lining decreased 26 per cent.

Manufacturing industries and "other uses."—The total quantity of stone sold for manufacturing industries and "other uses" decreased 3 per cent in 1924, although sales of some of the individual products increased. Pulverized limestone for agricultural purposes and asphalt filler and stone sold to sugar refineries and for the manufacture of calcium carbide increased in output, but stone sold for the manufacture of alkalies and magnesia products, as whiting substitute, to paper mills, glassworks, and to other chemical industries decreased.

Stone sold or used by the producers in the United States, 1923–24, by States

State	1923			1924		
	Number of active plants	Short tons (approximate)	Value	Number of active plants	Short tons (approximate)	Value
Alabama	28	[a] 1,299,160	[a] $1,401,693	28	1,253,990	$2,003,521
Alaska	1	([b])	([b])	1	([b])	([b])
Arizona	16	285,540	211,787	10	160,350	176,768
Arkansas	18	517,050	673,197	17	[a] 542,190	[a] 620,626
California	144	[c] 7,614,670	[c] 8,428,584	146	7,192,730	8,635,602
Colorado	52	[a] 543,480	[a] 749,798	46	825,940	1,221,574
Connecticut	43	1,482,710	1,830,413	41	[a] 1,849,670	[a] 2,251,566
Delaware	3	84,440	132,157	3	93,130	243,279
District of Columbia	5	7,470	20,576	5	8,370	15,760
Florida	25	1,494,080	1,425,434	29	2,973,360	2,942,778
Georgia	29	563,910	3,942,294	29	565,630	4,472,628
Hawaii	8	354,480	738,137	14	[a] 442,240	[a] 773,906
Idaho	19	175,050	205,486	27	211,030	318,588
Illinois	71	9,111,830	8,358,556	64	8,640,960	7,959,934
Indiana	95	3,650,110	17,692,112	91	[a] 3,824,440	[a] 17,269,407
Iowa	33	[a] 603,550	[a] 698,207	33	607,530	712,540
Kansas	53	919,640	1,180,397	40	[a] 766,120	[a] 960,626
Kentucky	96	1,884,380	2,250,025	74	2,173,700	2,786,249
Louisiana	2	([b])	([b])	2	([b])	([b])
Maine	60	306,620	3,168,396	44	[a] 263,720	[a] 2,411,938
Maryland	39	1,244,010	2,054,125	39	[a] 1,100,410	[a] 1,913,395
Massachusetts	109	1,788,860	5,794,941	98	[a] 1,936,520	[a] 6,063,048
Michigan	31	[a] 10,715,910	[a] 6,303,136	30	10,023,440	5,943,680
Minnesota	63	701,210	4,281,687	55	804,280	4,220,658
Mississippi	2	([b])	([b])	2	([b])	([b])
Missouri	120	2,134,910	4,345,526	120	[a] 2,320,010	[a] 4,961,333
Montana	24	[a] 275,900	[a] 270,781	19	251,730	235,580
Nebraska	11	243,920	328,918	9	222,030	285,977
Nevada	4	84,240	89,585	7	202,270	167,324
New Hampshire	31	122,460	1,763,221	26	[a] 93,340	[a] 1,556,598
New Jersey	55	2,039,740	3,032,918	52	2,149,270	3,326,298
New Mexico	6	[a] 396,980	[a] 241,786	8	654,610	432,023
New York	146	7,043,880	9,610,324	136	7,557,320	10,981,814
North Carolina	37	[a] 1,397,460	[a] 3,579,351	36	1,340,840	3,133,510
Ohio	141	11,493,340	11,464,569	135	10,455,060	11,280,865
Oklahoma	34	[a] 1,265,900	[a] 1,427,920	36	[a] 1,303,030	[a] 1,499,297
Oregon	73	1,103,330	1,342,070	93	1,592,530	1,624,602
Pennsylvania	470	[a] 15,679,170	[a] 18,997,295	444	[a] 14,559,490	[a] 17,966,836
Porto Rico	12	86,600	192,661	11	90,830	206,011
Rhode Island	20	[a] 161,080	[a] 649,359	22	[a] 171,350	[a] 742,701
South Carolina	12	847,870	1,657,926	11	824,030	1,527,114
South Dakota	19	250,730	479,288	15	[a] 166,970	[a] 362,508
Tennessee	47	1,454,180	4,341,393	55	[a] 1,437,280	[a] 3,867,072
Texas	36	2,200,690	2,102,281	32	2,207,050	1,886,798
Utah	15	784,750	608,991	17	640,100	446,490
Vermont	55	342,520	8,661,906	56	[a] 295,880	[a] 9,066,073
Virginia	64	2,216,140	2,482,937	61	2,223,620	2,566,575
Washington	43	678,880	953,831	63	[a] 778,460	[a] 1,596,088
West Virginia	32	2,550,710	2,660,415	57	2,618,290	3,040,154
Wisconsin	131	2,488,180	4,590,528	124	[a] 2,221,910	[a] 4,087,133
Wyoming	16	[a] 186,150	[a] 281,595	17	234,620	354,057
Undistributed	----------	440,790	1,771,728	----------	312,450	751,211
	2,699	[c] 103,318,660	[c] 159,470,241	2,630	103,184,120	161,870,113

[a] To avoid disclosing confidential information, certain State totals are slightly incomplete, the figures not included being combined under "Undistributed."

[b] Included under "Undistributed."

[c] Revised figures.

EXPORTS AND IMPORTS[1]

Value of stone exported from the United States, 1920–1924

Year	Marble and stone, unmanufactured	All other, manufactured	Total
1920	$774,442	$2,158,764	$2,933,206
1921	576,905	1,697,570	2,274,475
1922	681,658	903,102	1,584,760
1923	625,442	783,195	1,408,637
1924	499,602	448,731	948,333

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[1] The tables of exports and imports were compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Stone exported from the United States in 1924

Country	Marble				Other building or monumental stone		Other manufactures of stone (including paving blocks and curbing)		Total value
	Blocks (rough or dressed)		Manufactures						
	Cubic feet	Value	Short tons	Value	Cubic feet	Value	Short tons	Value	
North America:									
Canada	41,488	$181,647	141	$13,099	261,693	$272,692	4,388	$206,724	$674,162
Central America:									
British Honduras			(a)	106			5	863	969
Costa Rica							1	399	399
Guatemala							7	1,450	1,450
Honduras	6	37	13	1,232	10	5	2	679	1,953
Nicaragua							4	913	913
Panama	700	4,200	18	2,625			18	3,004	9,829
Salvador							2	465	465
Mexico	10	85	9	3,850	383	168	160	14,223	18,326
Newfoundland and Labrador	1,668	10,566	1	309	15	59	19	4,994	15,928
West Indies:									
British—									
Barbados			1	285			1	300	585
Bermuda			2	752			5	844	1,596
Jamaica			1	170			43	7,025	7,195
Trinidad and Tobago							(a)	75	75
Other	3	24	3	1,325	6	85	8	1,129	2,563
Cuba	3,593	17,239	34	5,027	1,401	9,647	122	19,177	51,090
Dominican Republic			2	460			18	2,538	2,998
Dutch	38	96	(a)	155			1	117	368
Haiti	12	64	2	448			1	338	850
Virgin Islands of the United States			1	450			23	826	1,276
Other							(a)	10	10
	47,518	213,958	228	30,293	263,508	282,656	4,828	266,093	793,000
South America:									
Argentina			3	688			2	966	1,654
Brazil							9	2,208	2,208
Chile							8	1,543	1,543
Colombia			(a)	200	729	479	18	7,244	7,923
Ecuador							4	635	635
Peru			3	992			79	11,453	12,445
Venezuela			(a)	25			4	1,095	1,120
Other							5	741	741
			6	1,905	729	479	129	25,885	28,269
Europe:									
France			(a)	80			6	1,922	2,002
Germany							8	1,688	1,688
Italy			1	250			(a)	20	270
Netherlands							71	10,973	10,973
United Kingdom—									
England	14	89	5	783			41	7,566	8,438
Scotland							1	121	121
Other			(a)	75	70	1,000	17	2,888	3,963
	14	89	6	1,188	70	1,000	144	25,178	27,455
Asia:									
China			3	937			41	9,821	10,758
India (British)			(a)	206	16	1,120	116	12,145	13,471
Japan			27	3,808			43	4,881	8,689
Philippine Islands							21	2,207	2,207
Other			(a)	275			22	3,126	3,401
			30	5,226	16	1,120	243	32,180	38,526
Africa:									
British South Africa			(a)	44			86	14,485	14,529
Other							9	1,621	1,621
			(a)	44			95	16,106	16,150
Oceania:									
Australia			3	400	10	300	146	32,659	33,359
New Zealand							81	11,120	11,120
Other							2	454	454
			3	400	10	300	229	44,233	44,933
Grand total	47,532	214,047	273	39,056	264,333	285,555	5,668	409,675	948,333

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[a] Less than 1 ton.

Stone imported for consumption in the United States, 1923–24

Kind	1923		1924	
	Quantity	Value	Quantity	Value
Marble, breccia, and onyx:				
In blocks, rough, etc. ... cubic feet	699, 412	$1, 513, 192	654, 510	$1, 278, 696
Sawed ... do	134	390	196	655
Slabs or paving tiles ... superficial feet	133, 244	54, 618	309, 999	97, 935
All other manufactures		283, 109		205, 353
Mosaic cubes of marble or onyx:				
Loose		21, 647		13, 016
Attached to paper				142
		1, 872, 956		1, 595, 797
Granite:				
Dressed		270, 432		302, 927
Rough ... cubic feet	176, 096	221, 796	196, 176	255, 225
		492, 228		558, 152
Stone (other):				
Dressed		17, 305		22, 044
Rough (monumental or building stone) ... cubic feet	80, 770	74, 377	152, 431	122, 309
Rough (other)		184, 471		139, 352
		276, 153		283, 705
Grand total		2, 641, 337		2, 437, 654

Marble, breccia, and onyx (rough and manufactured) imported into the United States, 1923–24, by countries

[General imports]

Country	1923				1924			
	Rough marble, breccia, and onyx		Manufactured	Total value	Rough marble, breccia, and onyx		Manufactured	Total value
	Cubic feet	Value			Cubic feet	Value		
Canada	8	$35	$717	$752	4	$27	$18, 281	$18, 308
Cuba							261	261
Guatemala					556	2, 301		2, 301
Mexico	5, 349	24, 933		24, 933	5, 506	19, 917	602	20, 519
Total North America	5, 357	24, 968	717	25, 685	6, 066	22, 245	19, 144	41, 389
Belgium	42, 486	85, 718	16, 951	102, 669	39, 912	64, 850	23, 941	88, 791
England	279	749	6, 296	7, 045			6, 924	6, 924
France	21, 150	49, 323	27, 423	76, 746	25, 291	47, 277	46, 124	93, 401
Germany	2, 243	5, 540	56, 500	62, 040	145	507	32, 483	32, 990
Greece	8, 619	35, 220		35, 220	5, 807	21, 659	80	21, 739
Italy	616, 111	1, 299, 710	231, 214	1, 530, 924	575, 758	1, 116, 997	177, 308	1, 294, 305
Netherlands			2, 769	2, 769			544	544
Spain			34	34			536	536
Other Europe [a]	893	2, 322	11, 821	14, 143	1, 707	5, 955	6, 408	12, 363
Total Europe	691, 781	1, 478, 582	353, 008	1, 831, 590	648, 620	1, 257, 245	294, 348	1, 551, 593
China			2, 925	2, 925			1, 542	1, 542
Japan			524	524			621	621
Other countries [b]	861	3, 202	3, 144	6, 346	1, 208	3, 309	1, 821	5, 130
	861	3, 202	6, 593	9, 795	1, 208	3, 309	3, 984	7, 293
Grand total	697, 999	1, 506, 752	360, 318	1, 867, 070	655, 894	1, 282, 799	317, 476	1, 600, 275

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[a] 1923: Austria, Czechoslovakia, Denmark, Gibraltar, Norway, Scotland, Sweden, Switzerland, and Turkey in Europe. 1924: Austria, Azores, etc., Czechoslovakia, Esthonia, Gibraltar, Hungary, Ireland, Rumania, Scotland, Sweden, Switzerland, and Turkey in Europe.

[b] 1923: Ceylon, Hongkong, India (British), Palestine and Syria, and Uruguay. 1924: Algeria and Tunis, Dutch West Indies, Honduras, Hongkong, India (British), Java and Madura, Palestine, Peru, and Uruguay.

Value of building or monumental stone (exclusive of marble, breccia, and onyx) and other classes of stone imported into the United States, 1923–24, by countries

[General imports]

Country	1923			1924		
	Building or monumental stone	Other stone	Total	Building or monumental stone	Other stone	Total
North America:						
Canada	$53, 129	$167, 724	$220, 853	$65, 431	$110, 932	$176, 363
Cuba	1	225	226	15		15
Mexico	10		10	24		24
	53, 140	167, 949	221, 089	65, 470	110, 932	176, 402
Europe:						
Austria	28		28	2		2
Belgium	1, 569	595	2, 164	24		24
Czechoslovakia	10, 280		10, 280	26, 069		26, 069
Denmark	2, 301	1, 088	3, 389		201	201
Finland	12, 967		12, 967	29, 749		29, 749
France	50, 570	14	50, 584	13, 212		13, 212
Germany	162, 986	11, 397	174, 383	138, 246	693	138, 939
Italy	97, 283	2, 017	99, 300	149, 042	25	149, 067
Netherlands	190	13, 464	13, 654		8, 368	8, 368
Norway	2, 706		2, 706	10, 453	30	10, 483
Portugal				2, 367		2, 367
Russia				95		95
Spain				7		7
Sweden	118, 695		118, 695	179, 950	1, 164	181, 114
United Kingdom—						
England	11, 683	20, 218	31, 901	18, 410	26, 542	44, 952
Scotland	74, 232		74, 232	98, 049		98, 049
	545, 490	48, 793	594, 283	665, 675	37, 023	702, 698
Other countries [a]	2, 239	18	2, 257	3, 368	1, 258	4, 626
Total imports	600, 869	216, 760	817, 629	734, 513	149, 213	883, 726

[a] 1923: Algeria and Tunis, China, Chosen, Hongkong, India (British), and Japan. 1924: Africa (British South), Brazil, Ceylon, China, Hongkong, and Japan.

PRODUCTION BY KINDS AND STATES

GRANITE

Granite showed a decrease of 6 per cent in quantity and 3 per cent in value in 1924. The building stone sold increased 31 per cent in quantity and 13 per cent in value. The output of stone sold rough for both ordinary and architectural construction increased. The total quantity of granite sold as finished stone increased although the quantity of cut stone included decreased (p. 269).

Granite sold for curbing, rubble, and for "other uses" also increased, but there was a decrease in sales of monumental stone, paving blocks, riprap, and crushed stone.

Granite sold or used by the producers in the United States, 1923–24, by uses

Use	1923		1924	
	Quantity	Value	Quantity	Value
Building stone (rough and dressed)……cubic feet	[a] 5,244,250	[a] $5,011,362	6,844,550	$5,663,776
Approximate equivalent in short tons	[a] 434,640	----------	556,530	----------
Monumental stone……cubic feet	[a] 3,947,600	[a] 12,398,457	3,520,530	11,447,196
Approximate equivalent in short tons	[a] 325,850	----------	289,140	----------
Paving……number of blocks	41,016,640	3,578,182	37,599,100	3,284,395
Approximate equivalent in short tons	414,930	----------	343,210	----------
Curbing……linear feet	2,104,150	1,436,212	2,251,760	1,513,137
Approximate equivalent in short tons	108,860	----------	113,550	----------
Rubble……short tons	167,980	183,589	235,150	243,156
Riprap……do	808,390	711,490	480,560	504,076
Crushed stone……do	5,009,280	6,230,109	4,806,570	5,935,591
Other uses……do	30,200	155,395	59,150	180,834
Total (quantities approximate, in short tons)	[a] 7,300,130	[a] 29,704,796	6,883,860	28,772,161

[a] Revised figures.

Granite sold or used by the producers in the United States, 1923–24, by States

[Quantities approximate]

State	1923		1924	
	Short tons	Value	Short tons	Value
Arizona	139,620	$56,813	66,310	$30,890
Arkansas	22,270	20,869	15,010	17,239
California	[a] 2,357,700	[a] 2,485,406	1,905,240	2,675,522
Colorado	47,090	190,356	2,220	152,209
Connecticut	23,650	285,004	72,030	340,785
Delaware	84,440	132,157	93,130	243,279
District of Columbia	7,470	20,576	8,370	15,760
Georgia	332,300	1,462,297	308,730	1,438,281
Idaho	([b])	([b])	26,560	26,560
Maine	258,580	3,059,608	225,570	2,311,686
Maryland	200,930	426,998	253,580	557,685
Massachusetts	552,450	3,687,169	581,470	3,930,877
Minnesota	68,540	2,979,014	66,560	2,606,536
Missouri	9,260	83,804	15,230	108,084
Montana	40,600	59,571	25,820	58,355
Nevada	----------	----------	([b])	([b])
New Hampshire	114,050	1,731,295	93,340	1,556,598
New Jersey	([b])	([b])	([b])	([b])
New York	61,220	204,578	68,360	211,766
North Carolina	1,265,540	3,376,778	1,141,270	2,766,740
Oklahoma	6,340	96,983	28,350	159,070
Oregon	----------	----------	18,970	32,800
Pennsylvania	189,420	599,578	281,500	768,307
Rhode Island	83,750	507,139	138,720	668,606
South Carolina	847,870	1,657,926	824,030	1,527,114
South Dakota	11,310	121,400	6,110	120,395
Texas	22,610	158,563	20,420	170,237
Utah	430	8,300	([b])	([b])
Vermont	132,860	4,000,440	112,480	4,081,009
Virginia	121,390	157,987	203,850	294,199
Washington	56,410	162,271	29,790	87,751
Wisconsin	221,580	1,935,592	204,030	1,746,546
Undistributed	20,450	36,324	46,810	67,275
	[a] 7,300,130	[a] 29,704,796	6,883,860	28,772,161

[a] Revised figures.
[b] Included under "Undistributed."

Granite sold or used by the producers in the United States, 1923–24, by States and uses

1923

State	Number of active plants	Building						Monumental				Paving blocks	
		Rough				Dressed		Rough		Dressed			
		Construction		Architectural									
		Short tons	Value	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value	Number	Value
Arizona	5									(a)	(a)		
Arkansas	4												
California	34	2,240	$4,480	102,150	$102,750	[b] 56,760	[b] $145,868	51,280	$113,373	[b] 47,130	[b] $360,686		
Colorado	16							(c)	(c)	[c] 30,510	[c] 133,206		
Connecticut	17	3,820	7,624	(c)	(c)	[c] 9,370	[c] 69,926	26,730	95,909	7,260	67,217	115,690	$10,249
Delaware	3	(a)	(a)	(a)	(a)			(a)	(a)	(a)	(a)		
District of Columbia	5	7,410	20,326										
Georgia	20	(a)	(a)	(c)	(c)	[c] 75,260	[c] 214,490	122,130	182,793	32,090	190,051	4,399,420	271,594
Idaho	1												
Maine	56	(a)	(a)	87,300	78,782	170,510	1,150,257	131,480	200,483	23,400	87,335	13,195,850	1,213,009
Maryland	11	107,190	229,571	(a)	(a)			[d] 17,270	[d] 21,411	(d)	(d)	(a)	(a)
Massachusetts	62	39,480	52,875	34,160	37,585	155,830	731,209	435,390	726,878	45,650	352,541	6,503,630	723,456
Minnesota	32			(c)	(c)	[c] 83,850	[c] 538,737	118,740	295,115	282,880	2,047,954	670,770	60,866
Missouri	4							(a)	(a)			433,000	40,640
Montana	12					3,890	19,430	2,830	3,712	1,660	20,090		
New Hampshire	28	4,380	5,714	39,990	36,399	99,630	534,324	105,300	195,349	60,240	441,799	5,055,210	356,779
New Jersey	1												
New York	12	4,600	6,272	11,700	11,847	2,180	16,846	11,370	26,775	1,240	9,569	(a)	(a)
North Carolina	31	1,730	3,040	62,010	55,546	34,330	184,825	(a)	(a)	(a)	(a)	3,844,310	293,286
Oklahoma	7							5,200	10,490	5,300	83,092		
Pennsylvania	27	133,730	283,080	(a)	(a)	(a)	(a)	23,010	44,362	16,400	138,953	(a)	(a)
Rhode Island	14	430	580	2,140	1,757			120,200	329,647			93,000	7,285
South Carolina	12	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)			417,500	30,945
South Dakota	4							(a)	(a)	(a)	(a)		
Texas	9			37,000	25,109			[d] 46,510	[d] 116,477	(d)	(d)		
Utah	1					2,590	3,240			2,530	5,060		
Vermont	36			(a)	(a)	(a)	(a)	[d] 1,492,160	[d] 3,810.525	(d)	(d)	(a)	(a)
Virginia	7	(a)	(a)										
Washington	6					(a)	(a)	(c)	(c)	[c] 9,250	[c] 52,480		
Wisconsin	23	(a)	(a)					22,240	42,160	140,650	1,126,328	5,326,400	495,954
Undistributed		32,140	154,850	78.950	52,517	30,190	231,506	426,870	531,894	82,640	534,743	961,860	74,119
	500	337,150	768,412	496,940	451,388	[b] 682,850	[b] 3,791,562	3,155,580	6,726,423	[b] 792,020	[b] 5,672,034	41,016,640	3,578,182

[a] Included under "Undistributed."
[b] Revised figures
[c] Rough stone included under dressed stone
[d] Dressed stone included under rough stone.

Granite sold or used by the producers in the United States, 1923–24, by States and uses—Continued

1923—Continued

State	Curbing		Rubble		Riprap		Crushed stone				Other uses		Total	
							Concrete and road metal		Railroad ballast					
	Linear feet	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons (approximate)	Value
Arizona	--------	--------	--------	--------	(a)	(a)	(a)	(a)	--------	--------	--------	--------	139,620	$56,813
Arkansas	--------	--------	(a)	(a)	(a)	(a)	8,070	$9,156	--------	--------	--------	--------	22,270	20,869
California	1,750	$3,474	--------	--------	366,430	$323,109	1,651,010	1,214,521	312,250	$211,345	4,600	$5,800	[b]2,357,700	[b]2,485,406
Colorado	--------	--------	--------	--------	(a)	(a)	43,800	56,450	--------	--------	(a)	(a)	47,090	190,356
Connecticut	13,580	12,579	--------	--------	--------	--------	14,500	21,500	--------	--------	--------	--------	23,650	285,004
Delaware	(a)	(a)	(a)	(a)	--------	--------	(a)	(a)	--------	--------	--------	--------	84,440	132,157
District of Columbia	1,150	250	--------	--------			--------	--------	--------	--------	--------	--------	7,470	20,576
Georgia	741,360	346,639	78,120	$64,918	12,200	15,932	141,440	170,222	4,000	3,000	(a)	(a)	332,300	1,462,297
Idaho	--------	--------	--------	--------	(a)	(a)	(a)	(a)	--------	--------	--------	--------	(a)	(a)
Maine	107,790	78,236	--------	--------	10,870	10,208	55,570	106,142	--------	--------	(a)	(a)	258,580	3,059,608
Maryland	--------	--------	2,990	6,385	(a)	(a)	62,980	91,473	(a)	(a)	--------	--------	200,930	426,998
Massachusetts	359,610	399,903	29,180	48,822	33,350	32,856	301,100	571,981	5,480	8,223	30	840	552,450	3,687,169
Minnesota	--------	--------	--------	--------	(a)	(a)	20,290	34,466	--------	--------	(a)	(a)	68,540	2,979,014
Missouri	--------	--------	--------	--------	2,630	2,393	(a)	(a)	--------	--------	--------	--------	9,260	83,804
Montana	(a)	(a)	(a)	(a)	8,510	6,792	--------	--------	--------	--------	(a)	(a)	40,600	59,571
New Hampshire	190,680	131,796	1,580	936	5,770	5,379	13,120	21,407	--------	--------	420	1,413	114,050	1,731,295
New Jersey	--------	--------	--------	--------	--------	--------	(a)	(a)	--------	--------	--------	--------	(a)	(a)
New York	(a)	(a)	(a)	(a)	--------	--------	13,700	17,834	25,570	20,811	(a)	(a)	61,220	204,578
North Carolina	624,040	392,390	9,440	29,799	(a)	(a)	991,010	1,620,337	109,000	115,000	12,180	90,267	1,265,540	3,376,778
Oklahoma	(a)	(a)	--------	--------	(a)	(a)	--------	--------	--------	--------	--------	--------	6,340	96,983
Pennsylvania	10,500	10,114	8,590	14,543	(a)	(a)	30,710	58,737	(a)	(a)	--------	--------	189,420	599,578
Rhode Island	(a)	(a)	1,390	3,147	(a)	(a)	67,640	156,869	--------	--------	2,680	2,000	83,750	507,139
South Carolina	(a)	(a)	(a)	(a)	101,480	135,464	595,600	976,300	112,000	124,896	--------	--------	847,870	1,657,926
South Dakota	--------	--------	--------	--------	--------	--------	(a)	(a)	--------	--------	--------	--------	11,310	121,400
Texas	(a)	(a)	--------	--------	15,730	15,727	--------	--------	--------	--------	(a)	(a)	22,610	158,563
Utah	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	430	8,300
Vermont	--------	--------	--------	--------	(a)	(a)	5,790	8,780	--------	--------	--------	--------	132,860	4,000,440
Virginia	--------	--------	--------	--------	(a)	(a)	93,290	123,167	20,400	17,520	--------	--------	121,390	157,987
Washington	--------	--------	--------	--------	55,130	59,525	--------	--------	--------	--------	(a)	(a)	56,410	162,271
Wisconsin	41,420	46,661	(a)	(a)	(a)	(a)	146,750	213,541	--------	--------	(a)	(a)	221,580	1,935,592
Undistributed	12,270	14,170	36,690	15,039	196,290	104,105	144,040	217,581	20,170	38,850	10,290	55,075	20,450	36,324
	2,104,150	1,436,212	167,980	183,589	808,390	711,490	4,400,410	5,690,464	608,870	539,645	[c]30,200	[c]155,395	[b]7,300,130	[b]29,704,796

[a] Included under "Undistributed."

[b] Revised figures.

[c] Includes 11,260 tons of durax paving blocks, valued at $95,450, made in Massachusetts, New Hampshire, North Carolina, and Wisconsin.

Granite sold or used by the producers in the United States, 1923–24, by States and uses—Continued

1924

State	Number of active plants	Building						Monumental				Paving blocks	
		Rough				Dressed		Rough		Dressed			
		Construction		Architectural									
		Short tons	Value	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value	Number	Value
Arizona	4							(a)	(a)	(a)	(a)		
Arkansas	4	(a)	(a)										
California	34	(a)	(a)	43, 150	$58, 864	105, 840	$756, 224	51, 140	$103, 829	35, 570	$264, 574	(a)	(a)
Colorado	8							12, 410	23, 437	14, 020	128, 772		
Connecticut	18	8, 230	$14, 454	(b)	(b)	[b] 35, 230	[b] 105, 113	[c] 32, 610	[c] 131, 400	(c)	(c)	(a)	(a)
Delaware	3	(a)	(a)										
District of Columbia	5	4, 540	7, 240										
Georgia	21	(a)	(a)			(a)	(a)	115, 090	168, 714	22, 610	157, 992	3, 869, 820	$234, 391
Idaho	5												
Maine	39	21, 230	54, 076	263, 260	217, 445	42, 040	296, 058	173, 760	195, 376	23, 660	80, 156	14, 561, 650	1, 337, 860
Maryland	12	125, 250	244, 113	[c] 43, 730	[c] 44, 431	(c)	(c)	(a)	(a)	(a)	(a)	(a)	(a)
Massachusetts	53	37, 290	83, 343	175, 790	166, 864	294, 380	1, 043, 867	393, 390	634, 345	32, 730	285, 876	6, 174, 760	663, 473
Minnesota	29			(b)	(b)	[b] 84, 270	[b] 599, 483	77, 580	206, 447	234, 590	1, 732, 392	(a)	(a)
Missouri	5			(a)	(a)			(a)	(a)			(a)	(a)
Montana	11					(a)	(a)	[c] 4, 460	[c] 16, 903	(c)	(c)		
Nevada	1												
New Hampshire	24	2, 030	2, 553	85, 950	81, 103	90, 630	586, 684	95, 780	172, 530	68, 490	259, 692	3, 335, 220	242, 968
New Jersey	1												
New York	10	(a)	(a)	(b)	(b)	[b] 9, 930	[b] 70, 894	[c] 2, 620	[c] 9, 523	(c)	(c)	(a)	(a)
North Carolina	29	4, 540	16, 573	[c] 127, 440	[c] 196, 789	(c)	(c)	[c] 107, 300	[c] 333, 845	(c)	(c)	2, 213, 330	155, 757
Oklahoma	10	(a)	(a)			(a)	(a)	13, 350	32, 402	10, 950	98, 290		
Oregon	3							(a)	(a)	(a)	(a)		
Pennsylvania	37	204, 160	394, 640	(a)	(a)	(a)	(a)	9, 890	24, 160	16, 630	130, 610	124, 450	11, 024
Rhode Island	16							174, 060	455, 741				
South Carolina	11	(a)	(a)			(a)	(a)	(a)	(a)			(a)	(a)
South Dakota	3					(a)	(a)	(a)	(a)	(a)	(a)		
Texas	9			9, 280	10, 300			[c] 57, 930	[c] 141, 937	(c)	(c)		
Utah	1							(a)	(a)				
Vermont	36			(b)	(b)	[b] 18, 900	[b] 161, 886	1, 254, 180	3, 772, 659	19, 710	134, 949	(a)	(a)
Virginia	7	(a)	(a)					(a)	(a)				
Washington	6					(a)	(a)	2, 010	4, 471	5, 670	57, 573		
Wisconsin	20	880	7, 048					15, 800	35, 774	99, 130	1, 020, 233	5, 185, 700	452, 287
Undistributed		11, 040	25, 940	109, 900	61, 236	121, 170	356, 555	322, 750	496, 297	20, 660	136, 297	2, 134, 170	186, 635
	475	419, 190	849, 980	860, 300	772, 953	800, 590	4, 040, 843	2, 874, 180	6, 661, 362	646, 350	4, 785, 834	37, 599, 100	3, 284, 395

[a] Included under "Undistributed."

[b] Rough stone included under dressed stone.

[c] Dressed stone included under rough stone.

Granite sold or used by the producers in the United States, 1923–24, by States and uses—Continued

1924—Continued

State	Curbing		Rubble		Riprap		Crushed stone				Other uses		Total	
							Concrete and road metal		Railroad ballast					
	Linear feet	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons (approximate)	Value
Arizona			(a)	(a)	(a)	(a)	(a)	(a)					66, 310	$30, 890
Arkansas			(a)	(a)	(a)	(a)	3, 000	$3, 980					15, 010	17, 239
California	(a)	(a)	(a)	(a)	203, 420	$187, 486	1, 045, 650	800, 936	631, 480	$486, 259	4, 740	$12, 728	1, 905, 240	2, 675, 522
Colorado													2, 220	152, 209
Connecticut	(a)	(a)			(a)	(a)	47, 250	47, 800			(a)	(a)	72, 030	340, 785
Delaware	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)					93, 130	243, 279
District of Columbia			(a)	(a)							(a)	(a)	8, 370	15, 760
Georgia	948, 360	$406, 829	85, 280	$41, 967	(a)	(a)	121, 920	137, 262	(a)	(a)			308, 730	1, 438, 281
Idaho							26, 560	26, 560					26, 560	26, 560
Maine	122, 580	113, 897	(a)	(a)	5, 650	6, 361	6, 040	8, 092					225, 570	2, 311, 686
Maryland			(a)	(a)	(a)	(a)	55, 990	102, 045	(a)	(a)	(a)	(a)	253, 580	557, 685
Massachusetts	297, 130	344, 022	76, 860	81, 710	23, 170	18, 501	256, 280	529, 858			35, 350	79, 018	581, 470	3, 930, 877
Minnesota			(a)	(a)	(a)	(a)	30, 140	43, 294					66, 560	2, 606, 536
Missouri					4, 000	5, 730	(a)	(a)			(a)	(a)	15, 230	108, 084
Montana					25, 150	21, 406					(a)	(a)	25, 820	58, 355
Nevada							(a)	(a)					(a)	(a)
New Hampshire	235, 760	185, 438	(a)	(a)	(a)	(a)	12, 400	21, 621			(a)	(a)	93, 340	1, 556, 598
New Jersey							(a)	(a)					(a)	(a)
New York			(a)	(a)			(a)	(a)	(a)	(a)	(a)	(a)	68, 360	211, 766
North Carolina	593, 590	413, 360	(a)	(a)	11, 130	6, 952	942, 120	1, 488, 007	103, 190	107, 488	(a)	(a)	1, 141, 270	2, 766, 740
Oklahoma					(a)	(a)	(a)	(a)					28, 350	159, 070
Oregon							(a)	(a)			(a)	(a)	18, 970	32, 800
Pennsylvania	13, 890	13, 561	9, 290	28, 018	(a)	(a)	33, 490	45, 564					281, 500	768, 307
Rhode Island	(a)	(a)	(a)	(a)			117, 540	199, 068			(a)	(a)	138, 720	668, 606
South Carolina	(a)	(a)	29, 930	39, 212	(a)	(a)	579, 540	837, 606	(a)	(a)			824, 030	1, 527, 114
South Dakota							(a)	(a)					6, 110	120, 395
Texas							(a)	(a)			(a)	(a)	20, 420	170, 237
Utah													(a)	(a)
Vermont							(a)	(a)					112, 480	4, 081, 009
Virginia			(a)	(a)	(a)	(a)	148, 120	204, 882	(a)	(a)			203, 850	294, 199
Washington					(a)	(a)	(a)	(a)					29, 790	87, 751
Wisconsin	(a)	(a)	(a)	(a)	(a)	(a)	129, 380	210, 204			760	4, 858	204, 030	1, 746, 546
Undistributed	40, 450	36, 030	33, 790	52, 249	208, 040	257, 640	208, 330	325, 035	308, 150	310, 030	18, 300	84, 230	46, 810	67, 275
	2, 251, 760	1, 513, 137	235, 150	243, 156	480, 560	504, 076	3, 763, 750	5, 031, 814	1,042,820	903, 777	[b] 59, 150	[b]180, 834	6, 883, 860	28, 772, 161

[a] Included under "Undistributed."
[b] Includes 3,342 tons of durax paving blocks, valued at $27,373, made in Massachusetts, Missouri, New York, North Carolina, and Wisconsin.

Monumental granite sold by the quarrymen at Quincy, Mass., 1920–1924

Year	Number of active plants	Short tons (approximate)	Value
1920	8	27,000	$674,233
1921	6	14,000	311,178
1922	6	16,000	341,601
1923	6	27,150	596,709
1924	6	26,630	527,915

Monumental granite sold by the quarrymen in the Barre district, Vt., 1920–1924

Year	Cubic feet	Value
1920	1,147,800	$3,957,881
1921	686,947	2,417,024
1922	453,000	1,395,911
1923	1,208,010	$3,300,805
1924	1,025,930	3,366,497

Through the kindness of R. E. Mitchell, secretary of the Barre Granite Manufacturers Association, the following figures covering the entire granite industry at Barre are given to supplement the figures of sales reported to the Bureau of Mines by the quarrymen:

Estimated output of monumental granite in Barre district, Vt., 1921–1924

	1921	1922	1923	1924
Total quarry output, rough stock...cubic feet	474,000	620,626	1,254,714	1,127,850
Shipped out of Barre district in rough...do	71,100	172,884	251,996	225,570
Manufactured in Barre district...do	402,900	447,742	1,002,718	902,280
Light stock consumed in district...do	251,813	279,841	626,701	563,925
Dark stock consumed in district...do	151,087	167,901	376,017	338,355
Number of cutters in district	1,100	1,000	1,250	1,000
Average daily wage	$8.00	$8.00	$8.00	$8.00
Average number of days worked	160	70	270	250
Total pay roll for year	$1,408,000	$560,000	$2,700,000	$2,000,000
Estimated overhead	704,000	280,000	1,350,000	1,000,000
Estimated value of light stock	906,527	940,265	2,256,123	2,352,585
Estimated value of dark stock	619,457	805,924	1,940,246	2,023,223
Estimated polishing cost	300,000	311,500	600,000	585,500
Output from saws	100,000	160,000	250,000	248,000
Total value of granite	4,037,984	3,057,689	9,096,369	8,209,308

The figures of quantity submitted by Mr. Mitchell represent the stone carried from the quarries. The figures of the Bureau of Mines represent the sales of stone as reported by the quarrymen.

BASALT AND RELATED ROCKS (TRAP ROCK)

The output of basalt and related rocks in 1924 increased 9 per cent in quantity and 8 per cent in value. Crushed stone, which is the chief product, increased 9 per cent in both quantity and value.

Under "other" is reported 76,220 short tons of roofing granules, valued at $516,390, made from altered diabase (greenstone). Included under granite and miscellaneous varieties of stone is a small amount of "roofing granules" which increased the tonnage of roofing granules made from stone to 77,370 tons, valued at $527,656. Besides these "roofing granules" others of slate (including slate "flour") amounting to 512,810 tons, valued at $3,178,454, were sold in 1924.

Basalt and related rocks (trap rock) sold or used by the producers in the United States, 1923–24, by uses

Use	1923		1924	
	Quantity	Value	Quantity	Value
Building stone____cubic feet__	463,380	$57,664	595,320	$77,145
Approximate equivalent in short tons____	39,530	----------	51,370	----------
Paving blocks____number__	241,120	8,342	----------	----------
Approximate equivalent in short tons____	2,580	----------	----------	----------
Rubble____short tons__	44,460	188,759	6,560	6,610
Riprap____do____	255,020	182,958	319,140	473,210
Crushed stone____do____	10,247,680	12,473,628	11,194,130	13,584,764
Other (principally roofing granules)____do____	85,200	628,297	100,300	537,794
Total (quantities approximate, in short tons)____	10,674,470	13,539,648	11,671,500	14,679,523

Basalt and related rocks (trap rock) sold or used by the producers in the United States, 1923–24, by States

[Quantities approximate]

State	1923		1924	
	Short tons	Value	Short tons	Value
California____	1,820,150	$1,798,640	1,672,020	$1,545,633
Colorado____	----------	----------	(a)	(a)
Connecticut____	1,441,840	1,517,286	1,762,620	1,883,625
Hawaii____	354,480	738,137	442,240	773,906
Idaho____	114,410	109,366	118,430	97,316
Maryland____	407,040	708,258	496,670	860,471
Massachusetts____	934,160	1,134,044	1,001,380	1,222,666
Michigan____	109,810	420,524	103,860	331,302
Minnesota____	176,710	257,334	225,910	381,164
Missouri____	----------	----------	(a)	(a)
Montana____	(a)	(a)	(a)	(a)
Nevada____	----------	----------	21,220	29,706
New Jersey____	1,596,170	2,422,338	1,808,260	2,806,365
New Mexico____	180,800	119,123	(a)	(a)
New York____	(a)	(a)	(a)	(a)
Oregon____	915,350	1,101,177	1,438,810	1,424,619
Pennsylvania____	1,384,500	1,940,670	1,269,190	1,798,564
Texas____	(a)	(a)	(a)	(a)
Virginia____	18,680	28,745	(a)	(a)
Washington____	553,280	521,027	668,410	829,632
Wisconsin____	148,000	228,000	(a)	(a)
Undistributed____	519,090	494,979	642,480	694,554
	10,674,470	13,539,648	11,671,500	14,679,523

[a] Included under "Undistributed."

Basalt and related rocks (trap rock) sold or used by the producers in the United States in 1924, by States and uses

State	Number of active plants	Building, rough construction		Rubble and riprap		Crushed stone				Other uses		Total	
						Concrete and road metal		Railroad ballast					
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons (approximate)	Value
California	23	(a)	(a)	(a)	(a)	1,456,130	$1,374,372	211,470	$154,565	(a)	(a)	1,672,020	$1,545,633
Colorado	2					(a)	(a)					(a)	(a)
Connecticut	18	(a)	(a)	117,250	$321,288	1,704,460	1,829,884	(a)	(a)			1,762,620	1,883,625
Hawaii	12					301,710	432,987	(a)	(a)	(a)	(a)	442,240	773,906
Idaho	11					118,430	97,316					118,430	97,316
Maryland	9	7,190	$11,848			262,710	510,717	226,770	337,906			496,670	860,471
Massachusetts	21	3,250	6,775			991,040	1,207,736	7,090	8,155			1,001,380	1,222,666
Michigan	6	(a)	(a)			57,880	86,102			(a)	(a)	103,860	331,302
Minnesota	5			(a)	(a)	147,610	232,296	66,380	60,794	(a)	(a)	225,910	381,164
Missouri	1					(a)	(a)					(a)	(a)
Montana	1			(a)	(a)							(a)	(a)
Nevada	1					21,220	29,706					21,220	29,706
New Jersey	33	(a)	(a)	(a)	(a)	1,622,290	2,568,255	182,740	234,267	(a)	(a)	1,808,260	2,806,365
New Mexico	1					(a)	(a)	(a)	(a)			(a)	(a)
New York	2					(a)	(a)	(a)	(a)			(a)	(a)
Oregon	77			99,320	87,758	1,324,300	1,315,718	15,190	21,143			1,438,810	1,424,619
Pennsylvania	29	13,000	25,345	410	770	979,800	1,286,306	245,230	297,491	30,750	$188,652	1,269,190	1,798,564
Texas	2					(a)	(a)	(a)	(a)			(a)	(a)
Virginia	1					(a)	(a)					(a)	(a)
Washington	44			90,840	56,143	561,940	766,489	15,630	7,000			668,410	829,632
Wisconsin	1					(a)	(a)					(a)	(a)
Undistributed		27,930	33,177	17,880	13,861	253,980	408,384	420,130	317,175	69,550	349,142	642,480	694,554
	300	51,370	77,145	325,700	479,820	9,803,500	12,146,268	1,390,630	1,438,496	[b] 100,300	[b] 537,794	11,671,500	14,679,523

[a] Included under "Undistributed."

[b] Includes 76,220 tons of roofing granules, valued at $516,390, from California, Michigan, Minnesota, and Pennsylvania.

MARBLE

Sales of marble decreased 8 per cent in quantity, but increased 3 per cent in value in 1924. The decrease was in marble sold as by-products or as waste material from the quarries. The quantity of marble sold for building and that for monumental work each increased 7 per cent. The quantity of marble reported as sold for exterior building decreased 6 per cent and that sold for interior work increased 15 per cent.

Marble sold by the producers in the United States, 1923–24, by uses

Use	1923		1924	
	Quantity	Value	Quantity	Value
Building stone:				
Rough—				
Exterior .... cubic feet..	230,460	$456,022	202,150	$416,216
Interior .... do....	616,920	1,438,011	744,350	1,664,343
Finished—				
Exterior .... do....	679,440	1,992,346	650,790	2,204,872
Interior .... do....	901,860	4,574,914	1,008,890	4,513,788
Total exterior .... do....	909,900	2,448,368	852,940	2,621,088
Total interior .... do....	1,518,780	6,012,925	1,753,240	6,178,131
Total building stone .... do....	[a] 2,428,680	[a] 8,461,293	[a] 2,606,180	[a] 8,799,219
Monumental stone:				
Rough .... do....	147,690	170,402	239,760	257,795
Finished .... do....	1,005,060	3,561,371	990,690	3,600,395
Total monumental stone .... do....	[a] 1,152,750	[a] 3,731,773	[a] 1,230,450	[a] 3,858,190
Total building and monumental .... cubic feet..	3,581,430	12,193,066	3,836,630	12,657,409
approximate short tons..	303,760	....	324,210	....
Marble for other uses (by-products) short tons..	258,800	670,908	191,790	644,826
Total marble, approximate short tons...	562,560	12,863,974	516,000	13,302,235

[a] Building-stone figures may be somewhat less than given and monumental stone somewhat more, as some of the Tennessee producers were unable to divide their product according to use.

Marble sold by the producers in the United States, 1923–24, by States

[Quantities approximate]

State	1923		1924	
	Short tons	Value	Short tons	Value
Alabama	[a] 24,970	[a] $958,189	33,140	$626,370
Alaska	[a] 11,110	[a] 377,622	[b] 10,360	[b] 466,920
Arizona	....	....	(b)	(b)
Arkansas	(a)	(a)	3,360	26,481
California	40,500	209,469	12,650	141,048
Colorado	(a)	(a)	(b)	(b)
Georgia	56,230	2,090,486	71,040	2,651,217
Maryland	[a] 14,040	[a] 171,250	[b] 14,200	[b] 188,813
Massachusetts	17,950	277,625	7,300	232,718
Michigan	(a)	(a)	....	....
Missouri	57,260	1,085,122	64,580	1,237,149
New Jersey	(a)	(a)	(b)	(b)
New York	63,570	412,875	64,220	532,358
North Carolina	(a)	(a)	(b)	(b)
Pennsylvania	(a)	(a)	(b)	(b)
Tennessee	101,600	2,706,688	97,950	2,332,337
Utah	(a)	(a)	(b)	(b)
Vermont	175,330	4,574,648	137,200	4,866,824
Virginia	(a)	(a)	(b)	(b)
Washington	(a)	(a)	(b)	(b)
	562,560	12,863,974	516,000	13,302,235

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[a] Alabama includes Arkansas; Alaska includes Colorado, Michigan, Utah, and Washington; Maryland includes New Jersey, North Carolina, Pennsylvania, and Virginia.

[b] Alaska includes Arizona, Colorado, Utah, and Washington; Maryland includes New Jersey, North Carolina, Pennsylvania, and Virginia.

SERPENTINE

The figures showing sales of serpentine (verde antique) in the United States for interior and exterior building, dimension stone, and by-products are included in this report in the figures for marble, but those showing sales of serpentine as crushed stone for road metal, ballast, riprap, and other low-grade material are included in the figures for "miscellaneous" stone. The States represented in the production of serpentine are Maryland, Massachusetts, New Jersey, Pennsylvania, Vermont, and Wyoming. The opening of new quarries in Windsor County, Vt., caused the considerable increase in serpentine sold for building.

Serpentine (verde antique) sold or used by the producers in the United States, 1923–24, by uses

Use	1923		1924	
	Quantity	Value	Quantity	Value
Building and ornamental stone____________cubic feet__	56, 712	$365, 668	88, 460	$501, 835
Rough construction, crushed, etc__________short tons__	11, 203	88, 904	8, 640	89, 347
	____________	454, 572	____________	591, 182

LIMESTONE

The quantity of limestone sold in 1924, as given in this report, was 1 per cent less than in 1923. This decline was mainly due to the decrease of 23 per cent in fluxing stone sold to blast furnaces, open-hearth steel works, smelters, and other metallurgical plants. Decreases were also noted in sales of limestone for building, curbing, flagging, and paving, glass factories, paper mills, and in the total quantity sold for miscellaneous "other" uses. Sales of rubble, riprap, crushed stone, agricultural limestone, and stone sold to sugar factories increased.

Limestone sold or used by the producers in the United States, 1923–24, by uses

Use	1923		1924	
	Quantity	Value	Quantity	Value
Building stone [a]____________________________cubic feet__	14, 639, 950	$16, 221, 095	14, 456, 320	$15, 805, 680
Approximate equivalent in short tons______________	1, 099, 390	____________	1, 097, 530	____________
Curbing, flagging, and paving_______________cubic feet__	75, 070	46, 830	69, 010	78, 264
Approximate equivalent in short tons______________	6, 600	____________	5, 560	____________
Rubble___________________________________short tons__	327, 180	484, 771	392, 180	623, 844
Riprap____do____	1, 536, 570	1, 451, 670	1, 695, 280	1, 513, 443
Crushed stone____________________________________do____	41, 386, 550	42, 540, 754	46, 446, 680	47, 594, 437
Fluxing stone____________________________________do____	25, 562, 140	20, 333, 939	19, 683, 150	15, 827, 464
Sugar factories___________________________________do____	474, 530	875, 774	618, 230	1, 055, 505
Glass factories___________________________________do____	197, 380	301, 403	177, 260	286, 164
Paper mills______________________________________do____	206, 740	326, 054	138, 280	236, 834
Agriculture______________________________________do____	1, 278, 770	2, 160, 249	1, 352, 600	2, 046, 860
Other uses [b]____________________________________do____	4, 625, 510	4, 877, 468	4, 287, 680	4, 800, 461
Total (quantities approximate, in short tons)_____	76, 701, 360	89, 620, 007	75, 894, 430	89, 868, 956

[a] Figures for building stone include small amounts of monumental stone.
[b] See table on p. 290 for further distribution of limestone products.

Limestone sold or used by the producers in the United States, 1923–24, by States

[Quantities approximate]

State	1923		1924	
	Short tons	Value	Short tons	Value
Alabama	1, 253, 500	$1, 362, 084	1, 170, 640	$1, 253, 971
Arizona	87, 900	89, 576	([a])	([a])
Arkansas	119, 800	121, 169	145, 710	125, 215
California	355, 150	629, 108	249, 860	540, 777
Colorado	386, 120	431, 374	561, 060	656, 193
Connecticut	([a])	([a])	([a])	([a])
Florida	1, 412, 410	1, 236, 226	2, 891, 610	2, 717, 486
Georgia	175, 380	389, 511	185, 860	383, 130
Idaho	32, 020	61, 758	11, 730	25, 253
Illinois	9, 020, 880	8, 309, 383	8, 577, 220	7, 916, 883
Indiana	3, 650, 110	17, 692, 112	3, 824, 440	17, 269, 407
Iowa	603, 550	698, 207	607, 530	712, 540
Kansas	907, 820	1, 156, 637	766, 120	960, 626
Kentucky	1, 835, 950	2, 075, 076	2, 153, 610	2, 629, 588
Louisiana	([a])	([a])	([a])	([a])
Maine	48, 040	108, 788	38, 150	100, 252
Maryland	625, 590	878, 745	350, 160	495, 239
Massachusetts	58, 410	189, 929	75, 560	216, 392
Michigan	10, 587, 070	5, 845, 649	9, 901, 910	5, 578, 642
Minnesota	329, 950	776, 162	457, 980	1, 101, 607
Mississippi	([a])	([a])	([a])	([a])
Missouri	2, 068, 230	3, 173, 622	2, 240, 200	3, 616, 100
Montana	228, 940	187, 362	206, 150	152, 644
Nebraska	243, 920	328, 918	222, 030	285, 977
Nevada	16, 140	27, 603	([a])	([a])
New Jersey	394, 090	473, 416	282, 700	390, 837
New Mexico	([a])	([a])	480, 720	288, 446
New York	6, 413, 380	7, 463, 884	6, 969, 060	8, 469. 975
North Carolina	131, 920	202, 573	114, 820	188, 470
Ohio	11, 135, 610	9, 123, 061	10, 040, 910	8, 534, 401
Oklahoma	1, 254, 740	1, 326, 266	1, 271, 930	1, 334, 647
Oregon	4, 020	13, 828	5, 710	17, 473
Pennsylvania	12, 558, 550	13, 753, 093	11, 558, 110	12, 778, 612
Porto Rico	86, 600	192, 661	90, 830	206, 911
Rhode Island	([a])	([a])	([a])	([a])
South Dakota	43, 280	70, 190	39, 360	60, 713
Tennessee	1, 352, 580	1, 634, 705	1, 339, 330	1, 534, 735
Texas	1, 834, 850	1, 616, 197	1, 872, 530	1, 483. 862
Utah	558, 140	457, 490	639, 220	408, 195
Vermont	27, 330	73, 318	46, 200	118, 240
Virginia	1, 995, 060	2, 220, 462	1, 928, 510	2, 200, 417
Washington	53, 540	116, 243	46, 420	108, 155
West Virginia	2, 531, 350	2, 634, 457	2, 334, 250	2, 503, 273
Wisconsin	1, 878, 220	2, 014, 942	1, 823, 970	1, 969, 885
Wyoming	186, 150	281, 595	222, 970	326, 446
Undistributed	215, 070	182, 627	149, 350	208, 241
	76, 701, 360	89, 620, 007	75, 894, 430	89. 868, 956

[a] Included under "Undistributed."

Limestone sold or used by the producers in the United States in 1924, by States and uses

State	Number of active plants	Building [a]						Rubble		Riprap		Crushed stone			
		Rough construction		Rough architectural		Finished (sawed and cut)						Concrete and road metal		Railroad ballast	
		Short tons	Value	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	18					(b)	(b)			32,910	$39,843	105,660	$111,293	77,720	$44,240
Arizona	2														
Arkansas	4									(b)	(b)	(b)	(b)		
California	22							(b)	(b)			67,170	79,676	6,510	5,194
Colorado	19			(b)	(b)					(b)	(b)	(b)	(b)	(b)	(b)
Connecticut	1														
Florida	21	(b)	(b)	(b)	(b)					19,280	15,800	2,653,980	2,487,183	194,600	178,983
Georgia	7									(b)	(b)	71,950	77,486	(b)	(b)
Idaho	4														
Illinois	61	(b)	(b)	(b)	(b)	(b)	(b)	17,620	$33,969	413,040	413,814	6,270,840	5,778,060	692,880	558,405
Indiana	90	(b)	(b)	4,659,210	$2,917,329	6,524,530	$11,702,291	6,230	3,979	48,240	31,133	2,501,550	2,205,929	157,890	93,747
Iowa	33	3,000	$4,681	(b)	(b)			(b)	(b)	41,980	48,830	434,460	533,500	38,940	33,415
Kansas	38	6,910	12,885	(b)	(b)			4,720	5,796	26,810	39,610	493,570	672,512	224,020	188,103
Kentucky	69	9,220	19,436			(b)	(b)	16,550	13,295	10,940	11,628	1,545,180	1,974,138	539,600	439,860
Louisiana	2											(b)	(b)	(b)	(b)
Maine	4											(b)	(b)		
Maryland	17	12,500	15,001									238,060	338,274		
Massachusetts	7											(b)	(b)		
Michigan	21	(b)	(b)					(b)	(b)	(b)	(b)	2,124,240	1,258,414	273,090	224,110
Minnesota	16	(b)	(b)	153,790	200,953	120,880	368,403	14,650	24,359	74,880	57,812	310,140	380,421		
Mississippi	2														
Missouri	106	2,870	4,333					202,820	394,687	277,760	347,758	1,491,010	2,433,438	113,670	125,070
Montana	5											16,230	13,306		
Nebraska	9									73,030	65,368	119,500	132,476	(b)	(b)
Nevada	1														
New Jersey	11											37,700	61,328		
New Mexico	5											(b)	(b)	(b)	(b)
New York	77	79,530	81,320	(b)	(b)	(b)	(b)	(b)	(b)	19,376	21,562	5,132,750	6,448,264	693,410	614,616
North Carolina	5	(b)	(b)	(b)	(b)							93,150	135,880		
Ohio	116	27,830	22,025					25,550	51,027	20,180	15,177	6,090,670	5,387,801	1,013,130	827,736
Oklahoma	20	3,270	6,441					(b)	(b)	30,730	26,561	935,910	1,078,449	294,300	215,308
Oregon	3														
Pennsylvania	265	22,490	32,381					1,590	1,777			3,637,920	5,013,677	77,210	95,624
Porto Rico	11							(b)	(b)	(b)	(b)	70,650	153,880	(b)	(b)
Rhode Island	2											(b)	(b)		
South Dakota	4									(b)	(b)	(b)	(b)		
Tennessee	31									16,490	11,459	707,690	729,525	451,500	374,636

Texas	20	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	40, 530	44, 238	950, 440	879, 105	862, 820	490, 853
Utah	14			(b)	(b)					(b)	(b)				
Vermont	9	(b)	(b)					(b)	(b)			32, 570	52, 623		
Virginia	50	(b)	(b)					(b)	(b)			875, 250	1, 087, 277	728, 660	664, 376
Washington	5														
West Virginia	28											344, 850	489, 913	325, 110	239, 441
Wisconsin	89	23, 810	38, 066					13, 150	24, 644	99, 060	129, 585	1, 518, 630	1, 526, 212	(b)	(b)
Wyoming	14	(b)	(b)							42, 540	16, 005	21, 570	27, 055		
Undistributed		48, 250	68, 342	199, 520	113, 331	106, 520	198, 462	89, 300	70, 311	407, 510	177, 260	319, 820	363, 956	468, 510	269, 668
	1, 358	239, 680	304, 911	5, 012, 520	3, 231, 613	6, 751, 930	12, 269, 156	392, 180	623, 844	1, 695, 280	1, 513, 443	39, 213, 110	41, 911, 051	7, 233, 570	5, 683, 386

[a] Figures for building stone include small amounts for monumental work.

[b] Included under "Undistributed."

Limestone sold or used by the producers in the United States in 1924, by States and uses—Continued

State	Fluxing stone		Sugar factories		Glass factories		Paper mills		Agriculture		Other uses		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons (approximate)	Value
Alabama	943,400	$956,343							(b)	(b)	(b)	(b)	1,170,640	$1,253,971
Arizona	(b)	(b)											(b)	(b)
Arkansas									(b)	(b)			145,710	125,215
California	64,100	125,746	(b)	(b)	(b)	(b)	(b)	(b)	14,660	$53,633	45,320	$146,261	249,860	540,777
Colorado	420,940	411,681	113,890	$195,262							940	1,414	561,060	656,193
Connecticut	(b)	(b)											(b)	(b)
Florida									(b)	(b)			2,891,610	2,717,486
Georgia	(b)	(b)							18,590	22,487	62,280	254,079	185,860	383,130
Idaho	(b)	(b)	(b)	(b)					(b)	(b)	2,960	6,588	11,730	25,253
Illinois	637,440	552,771			(b)	(b)			412,750	330,428	100,210	203,923	8,577,220	7,916,883
Indiana	88,860	30,128	27,480	30,029	(b)	(b)	(b)	(b)	100,440	87,397	11,050	68,673	3,824,440	17,269,407
Iowa	10,700	12,480	14,050	23,589					57,520	43,169	(b)	(b)	607,530	712,540
Kansas	(b)	(b)							(b)	(b)	(b)	(b)	766,120	960,626
Kentucky	(b)	(b)							17,670	18,793	4,500	29,000	2,153,610	2,629,588
Louisiana													(b)	(b)
Maine	(b)	(b)					(b)	(b)	(b)	(b)	(b)	(b)	38,150	100,252
Maryland	(b)	(b)							(b)	(b)	9,730	58,830	350,160	495,239
Massachusetts	(b)	(b)							34,170	106,009	(b)	(b)	75,560	216,392
Michigan	5,076,590	2,537,635	146,710	220,308			(b)	(b)	168,430	123,698	2,012,570	1,144,256	9,901,910	5,578,642
Minnesota	(b)	(b)							26,230	21,458	9,850	47,100	457,980	1,101,607
Mississippi									(b)	(b)			(b)	(b)
Missouri	59,740	80,921			30,460	$46,760			14,610	19,690	47,260	163,443	2,240,200	3,616,100
Montana	173,160	107,896	(b)	(b)					(b)	(b)			206,150	152,644
Nebraska	(b)	(b)	(b)	(b)					(b)	(b)	(b)	(b)	222,030	285,977
Nevada	(b)	(b)	(b)	(b)									(b)	(b)
New Jersey	192,280	173,188	(b)	(b)					27,870	79,735	(b)	(b)	282,700	390,837
New Mexico			(b)	(b)							(b)	(b)	480,720	288,446
New York	109,440	102,575					21,350	$33,202	67,120	181,092	845,280	984,195	6,969,060	8,469,975
North Carolina	(b)	(b)							19,360	46,050	(b)	(b)	114,820	188,470
Ohio	2,312,800	1,655,105			(b)	(b)	(b)	(b)	88,520	142,686	441,050	405,453	10,040,910	8,534,401
Oklahoma					(b)	(b)			(b)	(b)	(b)	(b)	1,271,930	1,334,647
Oregon							(b)	(b)	(b)	(b)			5,710	17,473
Pennsylvania	7,366,840	6,854,473			53,720	95,677	29,170	37,312	72,430	275,974	296,740	371,717	11,558,110	12,778,612
Porto Rico									7,230	35,220	(b)	(b)	90,830	206,011
Rhode Island	(b)	(b)											(b)	(b)
South Dakota			(b)	(b)									39,360	60,713
Tennessee	40,640	31,220							51,030	119,517	71,980	268,378	1,339,330	1,534,735
Texas	(b)	(b)			(b)	(b)			3,750	5,113	70	189	1,872,530	1,483,862
Utah	208,930	157,265	53,650	106,504									639,220	408,195
Vermont	(b)	(b)							(b)	(b)			46,200	118,240

Virginia	116,380	126,181							19,060	40,262	188,820	281,225	1,928,510	2,200,417
Washington	22,540	58,908	(b)	(b)			(b)	(b)	(b)	(b)	(b)	(b)	46,420	108,155
West Virginia	1,598,910	1,601,488							35,400	108,089	29,980	64,342	2,334,250	2,503,273
Wisconsin	(b)	(b)							57,900	87,098	42,140	98,711	1,823,970	1,969,885
Wyoming	(b)	(b)	156,210	263,270									222,970	326,446
Undistributed	239,460	251,460	106,240	216,543	93,080	143,727	87,760	166,320	37,860	99,262	70,510	280,948	149,350	208,241
	19,683,150	15,827,464	618,230	1,055,505	177,260	286,164	138,280	236,834	1,352,600	2,046,860	[c] 4,293,240	[c] 4,378,725	75,894,430	89,868,956

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[b] Included under "Undistributed."

[c] Includes 69,010 cubic feet of curbing, flagging, and paving, valued at $78,264.

Limestone sold or used by producers in the United States for miscellaneous uses, 1923–24

Use	1923		1924	
	Short tons	Value	Short tons	Value
Alkali works	3,338,910	$2,348,223	2,950,120	$2,074,509
Calcium carbide works	276,760	138,854	312,670	153,572
Refractory stone (dolomite)	205,890	249,993	309,010	287,137
Whiting substitute	81,310	514,258	66,910	417,326
Magnesia works	116,410	146,337	98,160	129,390
Asphalt filler	225,400	728,386	284,850	1,052,427
Mineral wool	6,940	9,333	7,530	14,808
Carbolic acid works	----------	----------	3,790	4,473
Carbonic acid works	19,830	37,164	34,600	57,105
Poultry grit	13,080	77,004	6,780	35,794
Coal mine dusting	----------	----------	3,020	13,240
Stucco	66,590	392,591	47,610	292,453
Roofing gravel	11,060	27,272	12,210	47,068
Other uses [b]	263,330	208,053	150,420	221,159
	4,625,510	4,877,468	4,287,680	4,800,461

[a] Included under "Other uses."
[b] Includes stone sold for manufacture of sulphuric acid, phosphates, terrazzo, artificial stone, ammonia, nitrates, soap, baking powder, and other chemicals, the purification of copper and the reduction of aluminum ore, for filter stone, road base, lime burners, livestock mixture, and uses not specified.

A considerable quantity of the limestone reported in the tables by uses is burned into lime—particularly the limestone reported by iron and steel producers and by alkali, sugar, and paper manufacturers, quarried by them and used in their own plants; also limestone sold to the manufacturers of these and other commodities who may burn it into lime before using it. To avoid duplication this lime is not included in the figures of production in the chapter on lime. Limestone manufactured into lime and into cement and reported in terms of finished product is treated in separate chapters. The quantities so used are estimated in the following table:

Limestone used for all purposes in the United States, 1922–1924, in short tons

Use	1922	1923	1924
Limestone (as given in this report)	58,928,660	76,701,360	75,894,430
Portland cement (including "cement rock")	30,070,000	34,722,000	37,727,000
Natural cement ("cement rock")	148,000	212,000	236,000
Lime	7,280,000	8,140,000	8,144,000
	96,426,660	119,775,360	122,001,430

BUILDING STONE

More than one-half of the total quantity of building stone sold in 1924 was limestone, the sales of which were slightly less than in 1923. The largest quarry center for building limestone, the Bedford-Bloomington district in Indiana, showed a decrease of 6 per cent from 1923. There was also a slight decrease in the sales of high-grade building limestone quarried at Russellville, Ala., and Bowling Green, Ky., but an increase in the total sales at Kasota, Mankato, Mantorville, and Winona, Minn., and at Leuders, Tex. Sales of limestone for rough construction increased somewhat as did sales of the cut stone for architectural work. Sales of rough blocks and of sawed stone for architectural work decreased (p. 269). The sales of limestone from the quarries and mills of the Bedford-Bloomington district in Indiana and from quarries at Mankato and Kasota, Minn., together with the sales of marble from the Carthage district, Mo., are given below. The Carthage stone is used, as is the Indiana stone, mainly for exterior building, and the figures of production are given here for convenience in comparison.

Indiana.—The quantity of building stone reported as sold in the Bedford-Bloomington oolitic limestone district, in Lawrence and Monroe Counties, Ind., in 1924 was 6 per cent less than in 1923, the year of record production. Besides the architectural stone sold, the waste stone is sold for flux, road metal, riprap, rubble, manufacture of paper and glass, and is manufactured into lime.

Limestone sold by the producers in the Bedford-Bloomington district, Lawrence and Monroe Counties, Ind., 1923–24

County	Number of active plants	Building stone					
		Rough blocks		Sawed stone		Semifinished stone	
		Cubic feet	Value	Cubic feet	Value	Cubic feet	Value
Lawrence	12	3, 197, 310	$2, 181, 422	1, 597, 390	$1, 683, 800	97, 520	$227, 168
Monroe	24	1, 397, 660	682, 795	2, 332, 370	2, 299, 047	147, 220	325, 871
	36	4, 594, 970	2, 864, 217	3, 929, 760	3, 982, 847	244, 740	553, 039
Total, 1923	36	4, 792, 580	2, 993, 984	4, 303, 860	4, 356, 584	577, 710	1, 252, 931

County	Building stone				Other		Total	
	Cut stone		Total					
	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Short tons (approximate)	Value
Lawrence	1, 643, 140	$5, 002, 055	6, 535, 360	$9, 094, 445	205, 770	$192, 415	679, 570	$9, 286, 860
Monroe	592, 960	1, 762, 083	4, 470, 210	5, 069, 796	50, 160	8, 097	374, 160	5, 077, 893
	2, 236, 100	6, 764, 138	11, 005, 570	14, 164, 241	255, 930	200, 512	1, 053, 730	14, 364, 753
Total, 1923	2, 020, 230	6, 644, 665	11, 694, 380	15, 248, 164	233, 180	167, 845	1, 081, 080	15, 416, 009

A considerable amount of stone is sold by the quarry operators to the finishing mills of the district. The dressed stone sold by these mills is shown in the following table:

Indiana oolitic limestone sold by the mills not operated by quarry companies in the Bedford-Bloomington district, Lawrence and Monroe Counties, Ind., 1923–24

Year	Sawed		Semifinished		Cut		Total	
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value
1923	202, 700	$183, 248	2, 830	$7, 545	1, 470, 970	$4, 614, 744	1, 676, 500	$4, 805, 537
1924	358, 260	354, 945	4, 660	12, 144	1, 391, 580	4, 287, 056	1, 754, 500	4, 654, 145

Minnesota.—The following table shows the sales of limestone at Mankato and Kasota, Minn., for the last three years:

Limestone sold by producers at Mankato and Kasota, Minn., 1922–1924

Year	Building stone (rough and dressed)		Other		Total	
	Cubic feet	Value	Short tons	Value	Short tons (approximate)	Value
1922	151, 110	$261, 275	29, 910	$32, 329	42, 600	$293, 604
1923	138, 890	312, 911	33, 980	34, 867	44, 900	347, 778
1924	130, 660	495, 036	46, 610	43, 152	65, 560	538, 188

Stone for architectural building purposes is also quarried at Mantorville and Winona, Minn.

Missouri.—The stone from the Carthage district, Mo., used for architectural building and for monumental work is classed as marble and is included in the figures of production of marble in Missouri given on page 283. The crushed stone and low-grade material are included under limestone, but all grades are combined to show the total production in the table below.

Limestone and marble sold by producers in the Carthage district, Jasper County, Mo., 1922–1924

Year	Building stone (rough and dressed)		Monumental stone (rough and dressed)		Other		Total	
	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Short tons (approximate)	Value
1922	368, 400	$692, 693	26, 330	$40, 471	68, 550	$176, 852	102, 300	$910, 016
1923	442, 680	782, 796	20, 630	32, 243	66, 070	167, 357	104, 760	982, 396
1924	435, 810	826, 294	25, 660	40, 505	78, 030	193, 944	116, 560	1, 060, 743

SANDSTONE

There was a decrease of 10 per cent in the quantity of sandstone sold or used by the producers in 1924. Sandstone sold for building stone, curbing, flagging, and "other" uses increased in quantity and that sold for paving blocks, crushed stone, riprap, rubble, and refractory stone decreased.

Sandstone sold or used by the producers in the United States, 1923–24, by uses

Use	1923		1924	
	Quantity	Value	Quantity	Value
Building stone .... cubic feet..	3,229,450	$2,130,552	3,550,530	$2,730,451
Approximate equivalent in short tons	245,870	------	263,580	------
Paving blocks .... number..	4,608,720	416,966	3,438,470	294,281
Approximate equivalent in short tons	44,700	------	32,650	------
Curbing .... cubic feet..	1,834,686	1,453,271	2,374,010	1,877,420
Approximate equivalent in short tons	136,840	------	176,960	------
Flagging .... cubic feet..	607,596	422,059	810,440	560,156
Approximate equivalent in short tons	43,860	------	59,840	------
Crushed stone .... short tons..	2,260,670	2,628,935	1,989,240	2,696,791
Riprap .... do....	341,120	441,634	278,210	364,036
Rubble .... do....	330,090	427,591	221,320	276,411
Refractory stone (ganister) .... do....	907,670	1,182,635	756,630	981,906
Other uses .... do....	38,450	71,063	116,260	360,647
Total (quantities approximate, in short tons).....	4,349,270	9,174,706	3,894,690	10,142,099

Sandstone sold or used by the producers in the United States, 1923–24, by States

[Quantities approximate]

State	1923		1924	
	Short tons	Value	Short tons	Value
Alabama	45,660	$39,609	50,210	$123,180
Arizona	43,730	46,344	------	------
Arkansas	(a)	(a)	(a)	(a)
California	647,980	835,138	622,180	765,364
Colorado	69,140	113,841	89,050	84,984
Connecticut	(a)	(a)	15,020	27,156
Idaho	(a)	(a)	37,760	150,484
Illinois	90,950	49,173	63,740	43,051
Indiana	------	------	(a)	(a)
Iowa	(a)	(a)	------	------
Kansas	11,820	23,760	(a)	(a)
Kentucky	48,430	174,949	20,090	156,661
Louisiana	(a)	(a)	------	------
Maryland	(a)	(a)	------	------
Massachusetts	2,510	98,147	(a)	(a)
Michigan	19,030	36,963	17,670	33,736
Minnesota	126,010	269,177	53,830	131,351
Missouri	160	2,978	------	------
Montana	6,360	23,848	(a)	(a)
New Jersey	20,120	26,600	11,190	18,441
New Mexico	216,180	122,663	------	------
New York	[b] 282,690	[b] 1,259,257	[b] 303,000	[b] 1,529,590
Ohio	357,730	2,341,508	414,150	2,746,464
Oklahoma	4,820	4,671	2,750	5,580
Oregon	148,200	207,680	81,900	106,752
Pennsylvania	[b] 1,405,330	[b] 2,359,306	[b] 1,322,260	[b] 2,305,743
South Dakota	192,740	284,127	121,500	181,400
Tennessee	------	------	(a)	(a)
Texas	(a)	(a)	(a)	(a)
Utah	225,700	116,601	(a)	(a)
Vermont	7,000	13,500	(a)	(a)
Virginia	48,380	27,724	(a)	(a)
Washington	(a)	(a)	21,070	563,075
West Virginia	19,360	25,958	284,040	536,881
Wisconsin	240,380	411,994	193,910	370,702
Wyoming	(a)	(a)	(a)	(a)
Undistributed	68,860	259,190	169,370	261,504
	4,349,270	9,174,706	3,894,690	10,142,099

[a] Included under "Undistributed."
[b] Includes bluestone.

Sandstone sold or used by the producers in the United States in 1924, by States and uses

State	Number of active plants	Building						Refractory stone (ganister)		Paving blocks		Curbing	
		Rough construction		Rough architectural		Dressed (sawed and cut)							
		Short tons	Value	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Number	Value	Cubic feet	Value
Alabama	7	(a)	(a)					(a)	(a)				
Arkansas	3	(a)	(a)									(a)	(a)
California	11			(a)	(a)			(a)	(a)				
Colorado	14	(a)	(a)	(a)	(a)			26,910	$33,109	(a)	(a)		
Connecticut	4	8,350	$10,659	(a)	(a)								
Idaho	4	(a)	(a)			(a)	(a)						
Illinois	3							(a)	(a)				
Indiana	1												
Kansas	2	(a)	(a)										
Kentucky	5	3,080	6,727	(a)	(a)	126,980	$146,163						
Massachusetts	2			(a)	(a)	(a)	(a)						
Michigan	3	(a)	(a)	(a)	(a)	(a)	(a)						
Minnesota	5			16,230	$13,157	17,750	18,300	1,050	1,001	50,820	$6,166		
Montana	2							(a)	(a)				
New Jersey	5	9,570	11,917			(a)	(a)						
New York	37	2,920	7,185	85,620	38,637	311,620	355,549			1,370,720	92,876	794,330	$699,340
Ohio	19	44,170	29,435	395,190	206,940	852,310	850,014	11,840	29,241			1,421,540	1,035,459
Oklahoma	5	1,860	3,288										
Oregon	6												
Pennsylvania	92	23,740	42,425	11,280	11,286	34,930	149,971	514,650	658,834	1,450,100	139,799	157,420	141,548
South Dakota	7	(a)	(a)					(a)	(a)	(a)	(a)		
Tennessee	1			(a)	(a)	(a)	(a)						
Texas	1												
Utah	1			(a)	(a)								
Vermont	1	(a)	(a)										
Virginia	2	(a)	(a)	(a)	(a)								
Washington	3			(a)	(a)	153,260	557,759						
West Virginia	29	(a)	(a)					(a)	(a)				
Wisconsin	14	2,500	4,307	5,910	5,267	(a)	(a)	141,060	169,826	(a)	(a)	(a)	(a)
Wyoming	2												
Undistributed		10,210	39,859	54,330	47,590	60,480	174,016	61,120	89,895	566,830	55,440	720	1,073
	291	106,400	155,802	568,560	322,877	1,557,330	2,251,772	756,630	981,906	3,438,470	294,281	2,374,010	1,877,420

Sandstone sold or used by the producers in the United States in 1924, by States and uses—Continued

State	Flagging		Rubble		Riprap		Crushed stone				Other uses		Total	
							Concrete and road metal		Railroad ballast					
	Cubic feet	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons (approximate)	Value
Alabama			11,600	$48,063									50,210	$123,180
Arkansas					(a)	(a)	(a)	(a)					(a)	(a)
California			(a)	(a)			422,090	$556,176	(a)	(a)			622,180	765,364
Colorado	(a)	(a)	1,370	2,367	57,370	$39,077	(a)	(a)					89,050	84,984
Connecticut			(a)	(a)	(a)	(a)							15,020	27,156
Idaho							(a)	(a)					37,760	150,484
Illinois							(a)	(a)					63,740	43,051
Indiana					(a)	(a)							(a)	(a)
Kansas	(a)	(a)					(a)	(a)					(a)	(a)
Kentucky					(a)	(a)							20,090	156,661
Massachusetts			(a)	(a)									(a)	(a)
Michigan							(a)	(a)					17,670	33,736
Minnesota			3,910	3,020	(a)	(a)	41,390	61,484			(a)	(a)	53,830	131,351
Montana													(a)	(a)
New Jersey					(a)	(a)					(a)	(a)	11,190	18,441
New York	115,410	$83,078			(a)	(a)	176,350	248,372	(a)	(a)			303,000	1,529,590
Ohio	644,230	427,757	5,700	12,674	52,700	49,389	57,290	88,146	(a)	(a)	(a)	(a)	414,150	2,746,464
Oklahoma			(a)	(a)	(a)	(a)							2,750	5,580
Oregon					(a)	(a)	(a)	(a)					81,900	106,752
Pennsylvania	48,270	47,949	8,590	18,381	17,620	43,621	531,960	811,875	177,370	$211,641	13,770	$28,413	1,322,260	2,305,743
South Dakota			(a)	(a)	2,380	2,254	106,340	153,276			(a)	(a)	121,500	181,400
Tennessee													(a)	(a)
Texas					(a)	(a)	(a)	(a)					(a)	(a)
Utah													(a)	(a)
Vermont			(a)	(a)			(a)	(a)					(a)	(a)
Virginia									(a)	(a)			(a)	(a)
Washington			(a)	(a)	(a)	(a)							21,070	563,075
West Virginia			(a)	(a)			196,650	304,007			79,320	222,908	284,040	536,881
Wisconsin			(a)	(a)	10,150	7,526	(a)	(a)	(a)	(a)	(a)	(a)	193,910	370,702
Wyoming					(a)	(a)	(a)	(a)					(a)	(a)
Undistributed	2,530	1,372	190,150	191,906	137,990	222,169	168,610	205,323	91,190	56,491	23,170	109,326	169,370	261,504
	810,440	560,156	221,320	276,411	278,210	364,036	1,720,680	2,428,659	268,560	268,132	116,260	360,647	3,894,690	10,142,099

[a] Included under "Undistributed."

BLUESTONE

The figures of production for bluestone are included in those for sandstone, but on account of the local importance of this stone they are also given separately. Except for a few of the large quarries the figures of sales reported by dealers rather than quarrymen are used by the Bureau of Mines, as more nearly representative of this industry. Stone for building decreased, and stone for curbing and flagging, the other important products, increased.

Bluestone sold in New York and Pennsylvania, 1923–24

State	Building stone		Curbing		Flagging		Other		Total	
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Short tons (approximate)	Value
1923										
New York	145,660	$240,596	268,150	$316,801	57,400	$41,917	7,450	$12,324	47,260	$611,638
Pennsylvania	13,730	6,913	93,800	94,915	39,620	46,280	100	300	12,250	148,408
	159,390	247,509	361,950	411,716	97,020	88,197	7,550	12,624	59,510	760,046
1924										
New York	121,870	268,226	370,520	363,649	112,110	81,778	17,100	17,130	68,160	730,783
Pennsylvania	16,480	14,115	100,980	101,701	47,280	46,265	2,400	4,440	16,310	166,521
	138,350	282,341	471,500	465,350	159,390	128,043	19,500	21,570	84,470	897,304

MISCELLANEOUS STONE

Practically all the material included under "miscellaneous" stone is used for road metal, concrete, and railroad ballast. In 1924 a considerable amount of riprap, mainly hornblende-mica schist from quarries opened in California, was reported sold for the construction of harbor improvements. The total output of miscellaneous stone increased 16 per cent in quantity in 1924. The increase in output of crushed stone was 10 per cent. Much crushed stone is quarried for jobs near quarries, and the quarries are closed when the work is completed. The State contributing the largest amount of miscellaneous stone is California. The output of this State includes rhyolite tuff (used as a building stone), andesite, rhyolite, trachyte, and other light-colored volcanic rocks, decomposed granite, hornblende-mica schist, and stone crushed from bowlders taken from river beds. The crushed bowlders are mostly from Los Angeles County, where part of the material taken out is sand, part screened gravel, and the rest is chiefly bowlders which are crushed. The sand and screened gravel obtained are included in the report on sand and gravel. Among the varieties of stone reported are andesite quarried in Arizona; argillite quarried in Arkansas, New Jersey, and Pennsylvania; phonolite from mine dumps in Colorado; cherty limestone or flint rock in Florida; rhyolite in Idaho and North Carolina; slate, conglomerate, and light-colored volcanic rocks in Massachusetts; and mica schist for building and refractory stone in Pennsylvania. There are also included from the other States volcanic cinders, coral rock, rhyolite, andesite, decomposed granite, mica crystal grit, "gyp" rock, "caliche," serpentine, field stone, and some stone, the variety of which is not known, reported by local contractors or operators of portable crushers as the product of road workings.

Miscellaneous varieties of stone[a] sold or used by the producers in the United States, 1923–24, by uses

Use	1923		1924	
	Quantity	Value	Quantity	Value
Building stone……cubic feet	411, 310	$140, 751	299, 480	$99, 385
Approximate equivalent in short tons	33, 500	----------	22, 940	----------
Riprap and rubble……short tons	236, 960	192, 882	501, 520	789, 911
Crushed stone……do	3, 418, 530	4, 055, 225	3, 761, 820	4, 049, 993
Refractory stone (mica schist)……do	38, 340	140, 166	28, 300	120, 370
Other uses……do	3, 540	38, 086	9, 060	45, 480
Total (quantities approximate, in short tons)	3, 730, 870	4, 567, 110	4, 323, 640	5, 105, 139

[a] Includes mica schist, conglomerate, argillite, various light-colored volcanic rocks, serpentine not used as marble, and such other stone as can not be properly classed in any of the main groups.

Miscellaneous varieties of stone sold or used by the producers in the United States, 1923–24, by States

[Quantities approximate]

State	1923		1924	
	Short tons	Value	Short tons	Value
Arizona	14, 290	$19, 054	43, 230	$80, 761
Arkansas	355, 790	425, 064	378, 110	451, 691
California	2, 393, 190	2, 470, 823	2, 730, 780	2, 967, 258
Colorado	41, 130	14, 227	(a)	(a)
Florida	81, 670	189, 208	81, 750	225, 292
Hawaii	----------	----------	(a)	(a)
Idaho	26, 710	30, 473	16, 550	18, 975
Maine	----------	----------	(a)	(a)
Massachusetts	223, 380	408, 027	270, 810	460, 395
Nevada	(a)	(a)	137, 080	62, 275
New Hampshire	8, 410	31, 926	(a)	(a)
New Jersey	(a)	(a)	(a)	(a)
New Mexico	----------	----------	(a)	(a)
New York	(a)	(a)	22, 600	49, 625
North Carolina	(a)	(a)	(a)	(a)
Oklahoma	(a)	(a)	(a)	(a)
Oregon	35, 760	19, 385	47, 140	42, 958
Pennsylvania	141, 370	344, 648	128, 430	315, 610
Rhode Island	77, 330	142, 220	32, 630	74, 095
South Dakota	3, 400	3, 571	(a)	(a)
Virginia	(a)	(a)	----------	----------
Washington	----------	----------	12, 770	7, 475
Wyoming	(a)	(a)	(a)	(a)
Undistributed	328, 440	468, 484	421, 760	348, 729
	3, 730, 870	4, 567, 110	4, 323, 640	5, 105, 139

[a] Included under "Undistributed."

CRUSHED STONE

Both the quantity and the value of the output of crushed stone in the United States increased 9 per cent in 1924 as compared with 1923. Stone for concrete and road metal increased 13 per cent in quantity and 12 per cent in value. Stone for railroad ballast decreased 7 per cent in quantity and 9 per cent in value. There was a decrease of 1 cent in the average value of stone for concrete and road metal and a decrease of 2 cents in that for railroad ballast. In 1924 as in 1923 a canvass was made of railroad companies in order to obtain more complete reports of the noncommercial material quarried and used by them. A similar canvass was made of the highway departments of all the States to ascertain the amount of noncommercial material used by them. The canvass, however, was not wholly successful, as only a few of the States could give entirely satisfactory information in either year.

Miscellaneous varieties of stone sold or used by the producers in the United States in 1924, by States and uses

State	Number of active plants	Building		Riprap and rubble		Crushed stone for concrete and road metal	
		Short tons	Value	Short tons	Value	Short tons	Value
Arizona	3	(a)	(a)	--------	--------	(a)	(a)
Arkansas	3	--------	--------	(a)	(a)	(a)	(a)
California	51	(a)	(a)	394, 900	$692, 395	2, 144, 720	$2, 107, 121
Colorado	1	--------	--------	(a)	(a)	(a)	(a)
Florida	8	--------	--------	--------	--------	81, 750	225, 292
Hawaii	2	--------	--------	--------	--------	(a)	(a)
Idaho	3	(a)	(a)	--------	--------	(a)	(a)
Maine	1	--------	--------	--------	--------	(a)	(a)
Massachusetts	12	(a)	(a)	3, 680	6, 675	264, 540	446, 977
Nevada	4	--------	--------	--------	--------	--------	--------
New Hampshire	2	--------	--------	--------	--------	--------	--------
New Jersey	1	(a)	(a)	--------	--------	(a)	(a)
New Mexico	2	--------	--------	--------	--------	(a)	(a)
New York	3	--------	--------	(a)	(a)	(a)	(a)
North Carolina	1	(a)	(a)	--------	--------	--------	--------
Oklahoma	1	--------	--------	(a)	(a)	--------	--------
Oregon	4	--------	--------	--------	--------	(a)	(a)
Pennsylvania	20	15, 710	$63, 855	(a)	(a)	74, 900	117, 389
Rhode Island	4	--------	--------	--------	--------	32, 630	74, 095
South Dakota	1	--------	--------	--------	--------	(a)	(a)
Washington	3	--------	--------	--------	--------	12, 770	7, 475
Wyoming	1	--------	--------	--------	--------	--------	--------
Undistributed	--------	7, 230	35, 530	102, 940	90, 841	571, 860	632, 551
	131	22, 940	99, 385	501, 520	789, 911	3, 183, 170	3, 610, 900

State	Crushed stone for railroad ballast		Other uses		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Arizona	--------	--------	--------	--------	43, 230	$80, 761
Arkansas	(a)	(a)	--------	--------	378, 110	451, 691
California	187, 680	$132, 937	(a)	(a)	2, 730, 780	2, 967, 258
Colorado	--------	--------	--------	--------	(a)	(a)
Florida	--------	--------	--------	--------	81, 750	225, 292
Hawaii	--------	--------	--------	--------	(a)	(a)
Idaho	--------	--------	--------	--------	16, 550	18, 975
Maine	--------	--------	--------	--------	(a)	(a)
Massachusetts	(a)	(a)	--------	--------	270, 810	460, 395
Nevada	(a)	(a)	(a)	(a)	137, 080	62, 275
New Hampshire	--------	--------	(a)	(a)	(a)	(a)
New Jersey	--------	--------	--------	--------	(a)	(a)
New Mexico	--------	--------	--------	--------	(a)	(a)
New York	--------	--------	--------	--------	22, 600	49, 625
North Carolina	(a)	(a)	(a)	(a)	(a)	(a)
Oklahoma	(a)	(a)	--------	--------	(a)	(a)
Oregon	(a)	(a)	--------	--------	47, 140	42, 958
Pennsylvania	(a)	(a)	29, 310	$123, 170	128, 430	315, 610
Rhode Island	--------	--------	--------	--------	32, 630	74, 095
South Dakota	--------	--------	--------	--------	(a)	(a)
Washington	--------	--------	--------	--------	12, 770	7, 475
Wyoming	--------	--------	(a)	(a)	(a)	(a)
Undistributed	390, 970	306, 156	8, 050	42, 680	421, 760	348, 729
	578, 650	439, 093	37, 360	165, 850	4, 323, 640	5, 105, 139

[a] Included under "Undistributed."

Crushed stone sold or used by the producers in the United States, 1923–24

Kind	Concrete and road metal		Railroad ballast		Total		
	Short tons	Value	Short tons	Value	Short tons	Value	
						Total	Average
1923							
Granite	4, 400, 410	$5, 690, 464	608, 870	$539, 645	5, 009, 280	$6, 230, 109	$1. 24
Basalt and related rocks (trap rock)	8, 550, 600	10, 793, 201	1, 697, 080	1, 680, 427	10, 247, 680	12, 473, 628	1. 22
Limestone	33, 382, 210	35, 925, 709	8, 004, 340	6, 615, 045	41, 386, 550	42, 540, 754	1. 03
Sandstone	1, 560, 300	2, 110, 230	700, 370	518, 705	2, 260, 670	2, 628, 935	1. 16
Miscellaneous	3, 154, 380	3, 836, 490	264, 150	218, 735	3, 418, 530	4, 055, 225	1. 19
	51, 047, 900	58, 356, 094	11, 274, 810	9, 572, 557	62, 322, 710	67, 928. 651	------
Average value per ton	------------	$1. 14	------------	$0. 85	------------	$1. 09	------
1924							
Granite	3, 763, 750	5, 031, 814	1, 042, 820	903, 777	4, 806, 570	5, 935, 591	1. 23
Basalt and related rocks (trap rock)	9, 803, 500	12, 146, 268	1, 390, 630	1, 438, 496	11, 194, 130	13, 584, 764	1. 21
Limestone	39, 213, 110	41, 911, 051	7, 233, 570	5, 683, 386	46, 446, 680	47, 594, 437	1. 02
Sandstone	1, 720, 680	2, 428, 659	268, 560	268, 132	1, 989, 240	2, 696, 791	1. 36
Miscellaneous	3, 183, 170	3, 610, 900	578, 650	439, 093	3, 761, 820	4, 049, 993	1. 08
	57, 684, 210	65, 128, 692	10, 514, 230	8, 732, 884	68, 198, 440	73, 861, 576	------
Average value per ton	------------	$1. 13	------------	$0. 83	------------	$1. 08	------
Percentage of increase or decrease in 1924	+13	+12	−7	−9	+9	+9	------

HIGH-MAGNESIUM LIMESTONE

In response to requests for information on producers of high-magnesium limestone and dolomite the following list of companies is published. Analyses of the stone produced by these companies are not available, but the companies themselves have reported on their statistical schedules—either in 1923 or 1924—that their stone was high-magnesium limestone containing from 25 to 45 per cent of $MgCO_3$. (Pure dolomite contains 45.65 per cent). The names are those of producers who have indicated that the composition of their product is within that range. Some of the companies listed below quarry high-calcium and low-magnesium as well as high-magnesium limestone. The arrangement of the table is alphabetical by State, county, and place. For companies having offices at places other than the quarries the office addresses are given.

Firms producing high-magnesium limestone

Alabama: Jefferson County—Birmingham (near)—Dolcito Quarry Co.; Republic Iron & Steel Co. (address, Youngstown, Ohio); Sloss Sheffield Steel & Iron Co.; and Tennessee Coal, Iron & R. R. Co.

Arkansas: Sharp County—Williford—Greenville Stone & Gravel Co. (address, Memphis, Tenn.).

California:

- Inyo County—Keeler—Inyo Marble Co. and Natural Soda Products Co.
- Monterey County—Salinas—Robert Porter.
- San Benito County—Hollister—Pacific Coast Steel Co. (address, San Francisco).
- Tuolumne County—Sonora—Pacific Lime & Plaster Co. (address, San Francisco).

Connecticut:

- Fairfield County—New Milford and Redding—New England Lime Co. (address, Danbury).
- Litchfield County—
  - Canaan—F. W. Barhoff (address, Hartford) and Connecticut Lime Co. (address, Lee, Mass.).
  - East Canaan and North Canaan—New England Lime Co. (address, Danbury).

- Georgia:
  - Bartow County—Cartersville—Ladd Lime & Stone Co.
  - Gilmer County—Whitestone (near)—Willingham-Little Stone Co. (address, Atlanta).
  - Pickens County—Whitestone—North Georgia Marble Products Co.
- Idaho: Kootenai County—Bayview—Washington Brick, Lime & Sewer Pipe Co. (address, Seattle, Wash.).
- Illinois:
  - Boone County—Belvidere—John Fair & Co. (lessee, Belvidere Stone Co.).
  - Cook County—
    - Chicago—Chicago Union Lime Works Co.; Consumers Co.; and Stearns Lime & Stone Co.
    - Hillside—A. C. O'Loughlin (Bellewood Quarry) (address, Chicago).
    - LaGrange—Consumers Co. (address, Chicago); Dolese & Shepard Co. (address, Chicago); Federal Stone Co. (address, Chicago); and Superior Stone Co. (address, Chicago).
    - Lemont—Consumers Co. (address, Chicago).
    - Lyons—Peoples Crushed Stone Co. (address, Chicago), and Riverside Lime & Stone Co. (address, Chicago).
    - Thornton—Brownell Improvement Co. (address, Chicago).
  - Du Page County—Elmhurst—Elmhurst-Chicago Stone Co.
  - Kankakee County—Lehigh—Lehigh Stone Co. (address, Kankakee).
  - Rock Island County—Port Byron—Port Byron Lime Association.
  - Will County—Joliet—Gross & McCowan Lumber Co.; Illinois State Penitentiary; Inland Crushed Stone Co.; Lincoln Crushed Stone Co.; Markgraf Stone Co.; National Stone Co.; and Swan, Medin & Co.
  - Winnebago County—
    - Rockford—Northern Illinois Supply Co.
    - Rockton—George W. Martin (address, Rockford).
- Indiana:
  - Adams County—Linngrove—Meshberger Bros. Stone Co.
  - Cass County—Logansport—The Logansport Stone & Lime Co. (address, Huntington).
  - Delaware County—Muncie—Muncie Stone & Lime Co.
  - Harrison County—Milltown—Louisville Cement Co. (address, Louisville, Ky.).
  - Huntington County—Huntington—The Erie Stone Co. (address, Toledo, Ohio) and The Kelley Island Lime & Transport Co. (address, Cleveland, Ohio).
  - Putnam County—Greencastle—Mid-West Crushed Stone Co. (address, Indianapolis); and The Ohio & Indiana Stone Co. (address, Toledo, Ohio).
  - Randolph County—Ridgeville—Mid-West Crushed Stone Co. (address, Indianapolis).
  - Wells County—Bluffton—The Erie Stone Co. (address, Toledo, Ohio).
  - White County—Monon—Monon Crushed Stone Co.
- Iowa:
  - Allamakee County—Postville—Wilkes Williams.
  - Dubuque County—
    - Dubuque—Eagle Point Lime Works.
    - Farley—B. N. Arquitt.
  - Jackson County—Maquoketa—A. A. Hurst.
- Kansas: Neosho County—Chanute—J. F. Byers.
- Maryland: Baltimore County—Cockeysville—Beaver Dam Marble Co. (address, Baltimore).
- Massachusetts: Berkshire County—
  - Ashley Falls—Berkshire Marble Co.
  - Lee—Lee Lime Co. and Lee Marble Works (Inc.).
  - Williamstown—D. S. McGrath (address, Adams).
- Michigan:
  - Charlevoix County—Bayshore—Northern Lime & Stone Co. (address, Petoskey).
  - Chippewa County—Fibre—Scott Quarry Co. (address, Sault Ste. Marie).
  - Delta County—Escanaba—Bichler Bros. (address, R. D. No. 1, Gladstone).
  - Dickinson County—
    - Felch—The Metro-Nite Co. (address, Milwaukee, Wis.).
    - Randville—Crystalite Reduction Co.

Michigan—Continued.
  Mackinac County—Trout Lake (Ozark Quarry)—Fiborn Limestone Co. (address, Sault Ste. Marie, Ontario).
  Monroe County—Monroe—The France Stone Co. (address, Toledo, Ohio).
  Schoolcraft County—Blaney, Manistique, Marblehead—Manistique Lime & Stone Co. (address, Manistique).
  Wayne County—River Rouge—Dunbar & Sullivan Dredging Co. (Stone dredged from Livingston Channel of River Rouge.)
Minnesota:
  Blue Earth County—Mankato—T. R. Coughlan Co. and Fowler & Pay.
  Dakota County—Mendota—Geo. C. Lauer Stone & Construction Co. (address, St. Paul).
  Fillmore County—Preston—Preston Crushed Rock Co.
  Goodhue County—Red Wing—Gust Lillyblad.
  Le Sueur County—Kasota—Babcock & Willcox and Breen Stone & Marble Co.
Nebraska:
  Cass County—Louisville—Hugh Murphy Construction Co. (address, Omaha).
  Gage County—Wymore—G. H. Davis (address, Blue Spring).
Nevada: Clark County—Sloan—Nevada Lime & Rock Co.
New Jersey:
  Hunterdon County—
    Califon—Bound Brook Crushed Stone Co. (address, Bound Brook) and E. J. Neighbour (address, Long Valley).
    Clinton—M. C. Mulligan & Sons.
  Somerset County—Peapack—Todd & Cordes.
  Sussex County—
    Andover—The Singer Manufacturing Co. (address, New York, N. Y.).
    Hamburg—Lime & Stone Products Corporation.
    Ogdensburg—Replogle Steel Co.
New York:
  Dutchess County—
    Dover Plains—The Kelley Island Lime & Transport Co. (address, Cleveland, Ohio).
    South Dover—South Dover Marble Co.
    Stoneco—Carbonate Lime Corporation (address, New York). and New York Traprock Corporation (address, New York).
  Essex County—Port Henry—Witherbee, Sherman & Co.
  Jefferson County—Natural Bridge—The Basic Refractories Corporation (address, York, Pa.).
  Monroe County—Rochester—Dolomite Products Co.
  Niagara County—Gasport—Wickwire Spencer Steel Corporation (address, Buffalo).
  Orange County—Newburgh—Newburgh Lime Manufacturing Co. (Inc.).
  Rockland County—Tomkins Cove—The Tomkins Cove Stone Co. (address, New York).
  Saratoga County—Saratoga Springs—Gailor Stone Co. (Inc.).
  Schenectady County—Pattersonville—Flint Hill Quarries (address, Troy).
  Ulster County—Marlboro—New York Traprock Corporation (address, New York).
  Westchester County—
    Tuckahoe—Benedict Stone Corporation (address, New York); Conlin Marble Co. (Inc.); and Kapailo Manufacturing Co. (Inc.) (address, New York).
    Verplanck—Carbonate Lime Corporation (address, New York); and New York Traprock Corporation (address, New York).
North Carolina:
  Henderson County—Asheville—Blue Ridge Lime Co.
  McDowell County—Marion—Clinchfield Lime Co. (address, Asheville).
  Madison County—Hot Springs—G. C. Buquo Lime Co.
  Swain County—Hewitts—North Carolina Talc & Mining Co.
Ohic:
  Adams County—Peebles—Basic Products Co. (address, Pittsburgh, Pa.).
  Allen County—Lima—The National Quarries Co. (address, Carey).
  Clark County—Springfield—J. W. Jenkins; National Mortar & Supply Co (address, Pittsburgh, Pa.); and The Moores Lime Co.

Ohio—Continued.
  Clinton County—Melvin—C. C. Beam.
  Delaware County—White Sulphur—American Crushed Rock Co. (address, Cleveland).
  Erie County—Sandusky—The Wagner Quarries Co.
  Franklin County—Dublin—J. M. Snouffer (address, Columbus).
  Green County—Cedarville—Abel Magnesia Co.
  Hancock County—Findlay—The Tarbox-McCall Stone Co.
  Hardin County—
    Dunkirk—The France Co. (address, Toledo).
    Forest—John Herzog & Son.
    Kenton—The France Quarries Co. (address, Toledo).
  Highland County—Greenfield—Rucker Quarries Co.
  Lucas County—
    Holland and Waterville—The France Stone Co. (address, Toledo).
    Sylvania—The Toledo Stone & Glass Co. (address, Toledo).
  Ottawa County—
    Clay Center—The Kelley Island Lime & Transport Co. (address, Cleveland).
    Genoa—United States Gypsum Co. (address, Chicago, Ill.).
    Limestone—Benton Lime & Stone Co. (address, Oak Harbor).
  Preble County—New Paris—The France Quarries Co. (address, Toledo).
  Putnam County—Pandora—The Schumacher Stone Co.
  Sandusky County—
    Bellevue—The Bellevue Quarries Co. (address, Toledo) and The France Stone Co. (address, Toledo).
    Fremont—The Gottron Bros. Co.
    Gibsonburg—National Mortar & Supply Co. (address, Pittsburgh, Pa.); The Kelley Island Lime & Transport Co. (address, Cleveland); and The Wm. L. Urschel Lime & Stone Co. (address, Toledo).
    Woodville—The Ohio Hydrate & Supply Co.; The Standard Lime & Stone Co. (address, Baltimore, Md.); and The Woodville Lime Products Co. (address, Toledo).
  Seneca County—
    Bascom—The Bascom Quarries Co. (address, Toledo).
    Bettsville—Kennedy Refractories Co. (address, Tiffin).
    Bloomville—The France Co. (address, Toledo).
    Maple Grove—The Dolomite Products Co. (address, Cleveland)
    Tiffin—Consumers Lime Co. (address, Fairmont, W. Va.) and The Kelley Island Lime & Transport Co. (address, Cleveland).
  Stark County—Canton—Stark Gray Lime Co.
  Van Wert County—
    Delphos and Wetzel—The Limestone Quarries Co. (address, Delphos).
    Middlepoint—The France Co. (address, Toledo).
  Wayne County—Fredericksburg—Blue Knob Crushed Stone Co.
  Wood County—
    Bowling Green—The Wood County Stone & Construction Co.
    Luckey—The Luckey Lime & Supply Co.
    North Baltimore—The France Stone Co. (address, Toledo).
    Stony Ridge—Miller Construction Co. (address, Toledo).
  Wyandot County—Carey—The National Lime & Stone Co.
Pennsylvania:
  Adams County—Hanover—Bethlehem Mines Corporation (address, Bethlehem).
  Berks County—
    Kutztown—Martin W. Koller.
    Reading—Oley Valley Quarry Co.
    Wernersville—Dietrick Bros. (address, Reading).
    West Reading—American Boron Products Co. (address, Reading).
  Chester County—
    Devault—Charles Warner Co. (address, Wilmington, Del.).
    Malvern—Knickerbocker Lime Co. (address, Philadelphia).
  Dauphin County—
    Hershey—Hershey Chocolate Co. and Miller & Rhoads Limestone Co.
    Highspire—Highspire Quarries (Walter C. Hocker).
    Hummelstown—Union Quarries Corporation.
    Steelton—Bethlehem Mines Corporation (address, Bethlehem).

Pennsylvania—Continued.
  Lancaster County—
    Bainbridge—J. E. Baker Co. (address, York).
    Lancaster—Dolomite Products Co.
    New Holland—Aaron Good & Bro.
    Refton—J. W. Breneman (address, R. D. No. 1, Willowstreet).
    Near Conowingo, Md. (in Lancaster County Pa.)—Octoraro Stone Co (Geiger Bros., address, Quarryville).
  Lebanon County—Lebanon—A. S. Craumer and Lebanon Stone Co.
  Lehigh County—
    Allentown—Kerfuter & Schaffer; Lehigh Pulverized Limestone Co.; Lehigh Valley Stone & Construction Co.; The New Jersey Zinc Company of Pennsylvania (address, New York, N. Y.); Trexler Lime & Supply Co.; and C. H. Ziegenfuss Co. (Inc.).
    Catasauqua—W. F. Eberhart & Bro.
    Centre Valley—Frank A. Kuntz.
  Montgomery County—
    Ambler—Keasbey & Mattison Co.
    Bridgeport—Pennsylvania Lime Products Co. and Charles Warner Co. (address, Wilmington, Del.).
    Flourtown—Blue Bell Lime Products Co. (Inc.).
    Norristown—Johns-Manville (Inc.) (address, New York, N. Y.); Lukens & Yerkes; and Merion Lime & Stone Co.
    Plymouth Meeting—American Magnesia & Covering Co. (address, Lockland, Ohio); G. & W. H. Corson; Cox Lime & Stone Co.; and E. J. Lavino & Co. (address, Philadelphia).
    Willow Grove—John J. Cannon.
  Northampton County—
    Bethlehem—Bethlehem Mines Corporation.
    Easton—Easton Lime Co.
    Nazareth—Industrial Limestone Co. (address, Allentown) and The Trumbower Co. (Inc.).
  York County—
    Dillsburg—D. Ott & Son.
    Emigsville—Emigsville Quarry Co.
    Mount Wolf—J. E. Baker Co. (address, York).
    York—Bethlehem Mines Corporation (address, Bethlehem) and Cunningham Bros.
South Dakota: Pennington County—Rapid City—Dark Canyon Stone Co.
Tennessee:
  Carter County—Milligan College—Cranberry Furnace Co.
  Knox County—
    Knoxville—Holton Quarry Co. (address, Strawberry Plains).
    Mascot—American Zinc Co. of Tennessee.
Utah:
  Salt Lake County—Salt Lake City—Langton Lime & Cement Co. and Western Lime & Silica Co.
  Tooele County—Grantsville—The Utah Lime & Stone Co. (address, Salt Lake City).
Vermont:
  Rutland County—Brandon—Brandon Rock Products Corporation.
  Windham County—Wilmington—Wilmington Limestone Pulverizing Co.
Virginia:
  Augusta County—Verona—Harry W. Bowling (address, R. D., Staunton).
  Botetourt County—
    Blue Ridge—Blue Ridge Stone Corporation (address, Roanoke).
    Buchanan—E. Dillon's Sons (Inc.) (address, Indian Rock) and Virginia Iron, Coal & Coke Co. (address, Roanoke).
  Giles County—
    Pembroke—Pembroke Limestone Corporation (address, Roanoke).
    Ripplemead—Virginian Limestone Corporation.
  Loudoun County—Mountville—Goose Creek Lime Works (address, Middleburg).
  Montgomery County—Radford—Radford Limestone Corporation (address, Roanoke).
  Roanoke County—Roanoke—Robert C. Churchill; A. J. Huff & Sons; and Rockydale Stone Co.
  Scott County—Clinchport—Simpson & Crawford (address, Glenita).

Washington: Stevens County—Colville—Crown Willamette Paper Co. (address, San Francisco, Calif.).

West Virginia:

- Jefferson County—Millville—Blair Limestone Co. (address, Pittsburgh, Pa.); Keystone Limestone Co. (address, Pittsburgh, Pa.); and The Standard Lime & Stone Co. (address, Baltimore, Md.).
- Monongalia County—Greer—Greer Limestone Co.
- Randolph County—Elkins—Gates & Bailey.

Wisconsin:

- Brown County—
  - Green Bay—Green Bay Sand & Gravel Co.
  - Green Leaf—The Western Lime & Cement Co. (address, Milwaukee).
- Calumet County—Brillion, Hayton, Highcliff—The Western Lime & Cement Co. (address, Milwaukee).
- Dodge County—
  - Knowles—Standard Lime & Stone Co. (address, Milwaukee) and The Western Lime & Cement Co. (Knowles and Nasbro quarries) (address, Milwaukee).
  - Mayville—Mayville Iron Co. (address, Chicago, Ill.) and Mayville White Lime Works.
  - Neda—Wisconsin Limestone Co.
- Door County—Sturgeon Bay—Leathem D. Smith Stone Co.
- Fond du Lac County—Hamilton, Marblehead—The Western Lime & Cement Co. (address, Milwaukee).
- Manitowoc County—
  - Grimms—The Western Lime & Cement Co. (address, Milwaukee).
  - Manitowoc—Allwood Lime Co. and Rockwell Lime Co. (address, Chicago, Ill.).
  - Maribel—Emil Schlegelmilch.
  - Quarry—The Western Lime & Cement Co. (address, Milwaukee).
  - Valders—Standard Lime & Stone Co. (address, Milwaukee) and The Western Lime & Cement Co. (address, Milwaukee).
- Outagamie County—Black Creek—Outagamie Limestone Co.
- Ozaukee County—
  - Cedarburg—John F. Groth & Son.
  - Grafton—Milwaukee Falls Lime Co.
- Pierce County—Elmwood—Wissota Sand & Gravel Co. (address, Eau Claire).
- Racine County—Racine—Consumers Co. (address, Chicago, Ill.) and North Shore Material Co. (address, Chicago, Ill.).
- Sheboygan County—
  - Elkhart Lake—Garden City Land & Lime Co. and Elkhart Sand & Gravel Co.
  - Sheboygan—Sheboygan Lime Works.
- Trempealeau County—Trempealeau—Trempealeau Lime Products Co.
- Washington County—Rockfield—Rockfield Products Co.
- Waukesha County—
  - Lannon—Central Lumber & Supply Co. (address, Beaver Dam); Davis Bros. Stone Co.; Schneider Stone Co.; and Lake Shore Stone Co. (address, Milwaukee).
  - Waukesha—Waukesha Lime & Stone Co.
- Winnebago County—Neenah—City of Neenah.

ASBESTOS

By Blanche H. Stoddard

PRODUCTION

The total sales of domestic asbestos in 1924, as reported by producers, were 300 short tons, valued at $42,526. These figures represent increases of 32 per cent in quantity and 342 per cent in value over 1923. Of the total quantity 173 tons, valued at $33,941, was chrysotile asbestos mined in Arizona, California, and Montana, and 127 tons was amphibole asbestos, valued at $8,585, mined in Georgia and Maryland.

Competition between the mines of Quebec, Canada, and Rhodesia, British South Africa, continued to be keen, and in consequence market quotations were comparatively low, but prices took a slight upward trend during the year on account of the pending merger of all Canadian asbestos properties. Efforts in this direction were, however, suspended, as one producer could not meet the proposed agreement, but in October, 1925, it was rumored that renewed effort was being made to bring about the merger. If such a merger is consummated greater efficiency in many directions may be expected, which probably will result in a readjustment of prices, lower costs, standardization of the product, and other improvements.

Asbestos sold by the producers in the United States, 1920–1924

Year	Chrysotile		Amphibole		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1920	1,245	$661,907	403	$16,324	1,648	$678,231
1921	438	313,268	393	23,700	831	336,968
1922	25	3,320	42	6,800	67	10,120
1923	69	4,433	158	5,193	227	9,626
1924	173	33,941	127	8,585	300	42,526

REVIEW BY STATES

Arizona.—The production of asbestos in Arizona in 1924 was many times greater than in 1923 or 1922. This increase was not directly due to concentrated effort on production but to the larger number of operators—five in 1924 as against two in 1923. The producers were as follows:

Producers of asbestos in Arizona, 1924

Name	Address	Location of property
William Andrews and others	Globe	4 miles northeast from Reynolds Creek Rangers Station, nearest post office Globe, Gila County.
Arizona Asbestos Association	Globe	Chrysotile, Gila County.
International Asbestos Co., W. G. Shanley, president.	Globe	45 miles north of Globe, Gila County.
Riga Asbestos Mining Co	1019-20 Detweiler Building, Los Angeles, Calif.	On Wilson Creek, about 7 miles from "Rock House," or 65 miles northeast of Globe, Gila County.
W. G. Shanley and C. R. Morrison.	450 S. Normandie Street, Los Angeles, Calif.	5¼ miles northeast of Chrysotile, Gila County.

California.—The only producer of asbestos in California in 1924 was the San Benito Asbestos Co., 400 Seventh Street, San Francisco (otherwise known as the California Asbestos Mining Co.), whose property is on Clear Creek near Coalinga, San Benito County. This company reported sales for the first time. No other developments of importance were reported from this State.

Georgia.—The Asbestos Mining & Manufacturing Co., Hollywood, Ga., a new operator in this field, produced and sold a quantity of mass-fiber anthophyllite and is endeavoring to develop ore reserves and improve the quality of the fiber.

The property of L. M. Arnold, Statham, Ga., was operated by a manufacturer of chemical filters.

Maryland.—The Powhatan Mining Corporation, Woodlawn, Baltimore, continued to prepare a high-grade filter fiber from slip-fiber anthophyllite.

Montana.—Peter F. Karst, Salesville, Mont., whose property is on Gallitan River, 20 miles south of Salesville, reported the production of 1 ton of asbestos.

More detailed descriptions concerning asbestos properties are contained in the report on asbestos in 1923.

PRICES

The prices of Canadian chrysotile asbestos (f. o. b. Quebec), which control domestic prices, are shown in Figure 3. These figures are based on an average of the quotations given in the Engineering and Mining Journal-Press.

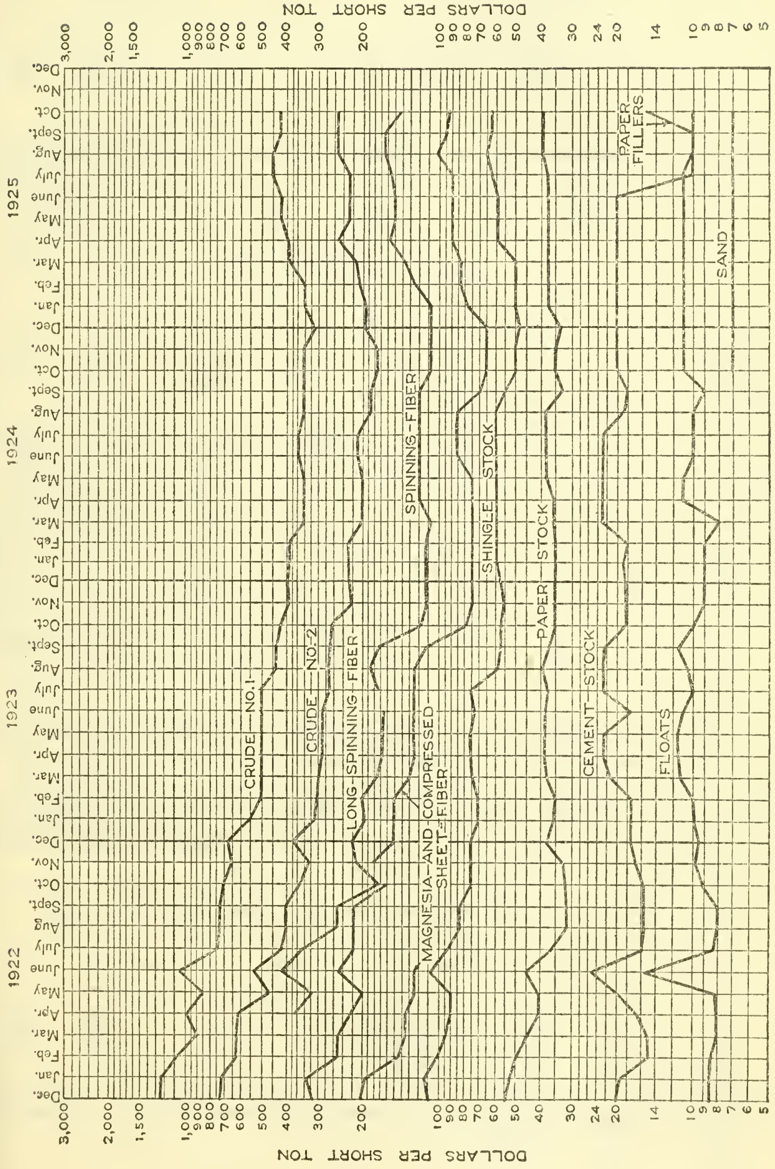

FIGURE 3.—Prices of Canadian asbestos, "crude" and "fiber," f. o. b., Quebec, 1922–1925

IMPORTS AND EXPORTS[1]

Asbestos (unmanufactured) imported for consumption in the United States, 1918–1924

Year	Short tons	Value	Year	Short tons	Value
1918	137,700	$6,337,608	1922	149,427	$5,144,700
1919	135,270	7,369,685	1923	212,420	7,445,143
1920	167,558	9,120,253	1924	183,250	5,602,945
1921	72,463	2,948,302			

Asbestos (unmanufactured) imported into the United States, 1923–24, by countries

Country	1923		1924	
	Short tons	Value	Short tons	Value
Africa:				
British South	280	$33,273	1,040	$100,194
Portuguese—				
East	1,832	288,314	1,049	181,549
Other	122	24,888	537	82,439
Australia	1	392		
Belgium			6	132
Brazil	(a)	43		
Canada	208,258	6,688,142	180,051	5,156,901
China	7	334		
Czechoslovakia	(a)	58		
England	1,760	376,306	417	67,201
France	(a)	47		
Germany	148	32,376	56	5,329
Greece			90	8,720
India (British)	1	392		
Italy	(a)	59	2	367
Japan	10	150		
Netherlands	1	369	2	92
Spain			(a)	21
	212,420	7,445,143	183,250	5,602,945

[a] Less than 1 ton.

In the foregoing table the countries given are merely the countries from which asbestos was last shipped as shown by the invoices or manifests from which the records of imports were compiled. It is probable that British South Africa (Rhodesia and the Union of South Africa) were the actual sources of all imports except those credited to Canada, Italy, and Brazil.

Asbestos (unmanufactured) exported from the United States, 1918–1924

Year	Short tons	Value	Year	Short tons	Value
1918	697	$51,053	1922	376	$49,939
1919	1,119	157,416	1923	680	48,525
1920	615	141,071	1924	1,270	93,163
1921	520	101,600			

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[1] Figures for imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

The exports of manufactured asbestos in 1923 and 1924 were as follows:

Manufactured asbestos products exported from the United States, 1923–1924, by grades

Grade	1923		1924	
	Quantity	Value	Quantity	Value
Paper, millboard, and roll board .... short tons..	1,780	$190,755	1,086	$124,228
Pipe covering and cement .... do....	2,834	426,085	2,424	288,266
Textile yarn and packing .... do....	519	672,488	599	788,361
Magnesia pipe and boiler covering .... do....	2,696	337,044	1,560	243,579
Asbestos roofing .... squares..	104,445	423,392	48,968	297,900
Other manufactures, except roofing .... short tons..	1,625	800,623	1,364	787,461

WORLD'S PRODUCTION[2]

World's production of asbestos, 1920–1924, in metric tons

Country	1920	1921	1922	1923	1924
Africa:					
Rhodesia, Southern	17,076	17,716	12,926	18,474	23,715
Union of South Africa	6,452	4,646	3,981	7,614	6,752
Australia:					
New South Wales	675	960	570	207	----------
South Australia	5	2	----------	7	4
Western Australia	159	239	184	117	75
Canada	162,038	61,083	145,456	196,680	189,203
China [a]	5	169	197	[b] 128	(c)
Cyprus [a]	911	911	166	2,186	222
Finland	252	750	785	(c)	(c)
France	445	500	610	(c)	(c)
Germany (Bavaria)	28	(c)	(c)	(c)	(c)
India	1,847	321	246	251	127
Italy	165	420	540	1,538	2,160
Japan	(c)	(c)	933	826	(c)
New Zealand	2	(d)	----------	----------	----------
Russia	1,478	2,604	3,215	7,153	[e] 7,948
Spain	----------	19	5	----------	----------
United States	1,495	754	61	206	272

[a] Exports.
[b] A production of 7,068 metric tons is reported for China in 1923. (Imp. Min. Res. Bur., London.)
[c] Data not available.
[d] Less than half a ton.
[e] Data relate to operating year ended Sept. 30, 1924.

Asbestos shipped from mines in British South Africa, 1913–1924, in metric tons

Year	Southern Rhodesia	Transvaal	Cape Colony	Natal
1913	263	----------	851	22
1914	442	27	1,052	----------
1915	1,823	50	1,890	----------
1916	5,586	369	3,836	19
1917	8,674	2,897	2,721	25
1918	7,778	844	2,485	4
1919	8,889	572	2,906	89
1920	17,076	3,212	3,199	41
1921	17,716	1,445	3,145	56
1922	12,926	1,263	2,713	5
1923	18,474	3,698	3,916	----------
1924	23,715	3,954	2,798	----------

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[2] Figures for world's production compiled by L. M. Jones, of the Bureau of Mines.

BARYTES AND BARIUM PRODUCTS [1]

By C. E. Siebenthal and A. Stoll

Sales of domestic crude and of ground barytes decreased 8 and 3 per cent, respectively, in 1924 as compared with 1923. On the other hand, sales of lithopone and the barium chemicals showed gains of 11 and 8 per cent, respectively, during the same period.

CRUDE BARYTES

SALES

Shipments of domestic crude barytes in 1924 amounted to 196,332 short tons, valued at $1,540,744. Although these figures represent a loss of 8 per cent in quantity and 7 per cent in value, as compared with the preceding year, the industry as a whole has been characterized by a steady demand, better equipment for production, and more satisfactory railroad service. The demand of buyers for cleaner ores has been one factor in raising the standard of quality of the ore sold.

Crude barytes shipped by producers in the United States, 1901–1924

Year	Short tons	Value f. o. b. at mine		Year	Short tons	Value f. o. b. at mine	
		Total	Average			Total	Average
1901–1915 (average)	56, 061	$180, 669	$3. 22	1922	155, 040	$1, 123, 950	$7. 25
1916–1920 (average)	204, 330	1, 419, 521	6. 95	1923	214, 183	1, 664, 156	7. 77
1921	66, 369	531, 958	8. 02	1924	196, 332	1, 540, 744	7. 85

Crude barytes shipped by producers in the United States, 1923–24, by States

State	1923				1924			
	Short tons	Percentage of total	Value f. o. b. at mine		Short tons	Percentage of total	Value f. o. b. at mine	
			Total	Average			Total	Average
Georgia	83, 291	39	$670, 343	$8. 05	71, 776	37	$574, 208	$8. 00
Missouri	81, 701	38	629, 097	7. 70	77, 189	39	604, 390	7. 83
North Carolina	1, 179	1	7, 076	6. 00	([a])	([a])	([a])	([a])
Tennessee	34, 384	16	259, 005	7. 53	39, 643	20	302, 873	7. 64
Other States [b]	13, 628	6	98, 635	7. 24	7, 724	4	59, 273	7. 67
	214, 183	100	1, 664, 156	7. 77	196, 332	100	1, 540, 744	7. 85

[a] Included under "Other States."

[b] 1923: Alabama, California, Kentucky, South Carolina, Virginia, and Wisconsin. 1924: Alabama, Nevada, North Carolina, South Carolina, Virginia, and Wisconsin.

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[1] A chapter on barytes and barium products that was accompanied by a map showing the location of barytes deposits and barium-product manufactories was given in Mineral Resources for 1915.

The average value per ton, based on total sales of crude barytes by producers in the United States in 1924, was a few cents higher than in 1923. Missouri ranked first in the amount sold and exceeded Georgia by a little more than 5,000 tons. Tennessee held third place and had a greater output than in any preceding year. A small production again was reported in Nevada, and development in Jefferson County, Mont., gives expectation of future output from another Western State. The property formerly mined by the Western Rock Products Co. in Mariposa County, Calif., made no sales in 1924 and reverted to the owner, the El Portal Mining Co.

IMPORTS AND EXPORTS[2]

The barytes imported in recent years was purchased for use in plants in the eastern part of the United States, and most of it was shipped from Germany. During the war the imports of barytes nearly ceased, but in the period 1920–1924 they averaged annually only 2,690 tons less than the average of 1911–1915.

Crude barytes imported for consumption in the United States, 1911–1924

Year	Short tons	Value [a]		Year	Short tons	Value [a]	
		Total	Average			Total	Average
1911–1915 (average)	21,833	$40,436	$1.85	1920	24,874	$146,858	$5.90
1916	17	245	14.41	1921	11,054	59,371	5.37
1917	6	63	10.50	1922	23,239	104,680	4.50
1918	----------	----------	----------	1923	15,045	93,721	6.23
1919	118	594	5.03	1924	21,502	104,264	4.85

[a] Value at port of shipment, on which duty is levied. Does not include railroad and ship freight charges to this country or import duty.

Exports of barytes are not separately classified by the Bureau of Foreign and Domestic Commerce.

CONSUMPTION BY USES

The two tables that follow show the consumption of domestic and imported barytes in the United States by uses. The figures were compiled from reports made by the manufacturers of barium products.

Crude barytes (both domestic and imported) used in the manufacture of barium products in the United States, 1918–1924, in short tons

Year	In ground barytes	In lithopone	In barium chemicals	Total	Year	In ground barytes	In lithopone	In barium chemicals	Total
1918	62,440	85,282	38,041	185,763	1922	48,280	94,259	25,303	167,842
1919	64,922	103,688	32,976	201,586	1923	47,713	128,547	34,327	210,587
1920	79,052	113,181	37,210	229,443	1924	42,855	137,127	33,181	213,163
1921	28,296	61,359	10,952	100,607					

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[2] The statistics of imports were compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Domestic and imported crude barytes used in the manufacture of barium products in the United States in 1924, by States

State	Product manufactured	Plants	Barytes used (short tons)
Illinois	Lithopone and chemicals	6	37,704
Missouri	Ground barytes and chemicals	4	42,091
New Jersey	Lithopone and chemicals	3	38,471
New York	Chemicals	3	42,802
Pennsylvania	Lithopone and chemicals		
Delaware and Maryland	Lithopone	3	43,909
West Virginia	Chemicals		
South Carolina and Georgia	Ground barytes	3	8,186
Tennessee	Chemicals		
		22	213,163

WORLD'S PRODUCTION

The following table, prepared by L. M. Jones, of the Bureau of Mines, shows the output of barytes by various countries, so far as statistics are available:

World's production of barytes, 1920–1924, in metric tons

Country	1920	1921	1922	1923	1924
Algeria	(a)	(a)	1,200	700	500
Australia:					
New South Wales	226	203		102	152
South Australia	2,583	1,289	1,908	1,789	1,928
Tasmania	1,065				
Western Australia [b]		2	19		
Austria	(a)	2,080	2,140	2,377	1,399
Belgium	15,240	17,050	1,480	6,770	20,490
Canada	681	245	262	371	137
France	18,782	11,297	12,634	(a)	(a)
Germany:					
Bavaria	7,888	23,439	16,139	19,970	(a)
Prussia	103,976	85,322	164,365	97,207	155,567
India (British)	689	1,480	2,430	2,611	2,340
Italy	15,380	13,500	21,300	27,592	39,568
Rhodesia, Southern				9	64
Russia	328	(a)	(a)	(a)	(a)
Spain	13,773	910	[c] 2,075	[c] 11,764	[c] 6,768
United Kingdom	65,180	25,065	41,606	44,195	55,646
United States	206,940	60,209	140,649	194,303	178,108

[a] Data not available.

[b] Exports.

[c] Exclusive of the following quantities produced from quarries in the Province of Leon: 1922, 1,224 cubic meters; 1923, 1,450 cubic meters; 1924, 1,670 cubic meters.

BARIUM PRODUCTS

A gain of 7 per cent in quantity and of 6 per cent in value of barium products (excluding barium chemicals made from barium products bought in the open market) sold by producers in the United States in 1924 showed the prosperous condition of this industry. The greatest gain was in lithopone, the tonnage sold increasing 11 per cent over the sales in 1923.

Barium products made from domestic and imported crude ores in the United States and sold, 1923–24

Product	1923			1924		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Ground barytes	39,605	$895,095	$22.60	38,296	$784,881	$20.50
Lithopone	98,199	11,608,443	118.21	109,469	12,531,397	114.47
Barium chemicals [a]	16,803	1,231,646	73.30	18,154	1,213,900	66.87
	154,607	13,735,184	88.84	165,919	14,530,178	87.57

[a] Barium chemicals manufactured from barium products bought in open market are not included in table in order to avoid duplication; the total output of barium chemicals is therefore not shown above.

REFINED GROUND BARYTES

Barytes is ground to very fine powder, leached with acid, and washed for use as a pigment, a filler, and an inert base. Most barytes is refined by flotation on a stream of water, whereby only the most impalpable powder is obtained. As a pigment it is used chiefly in interior flat white or light-colored paints. As a filler it is extensively used in rubber goods, linoleum, oilcloth, highly glazed paper, and similar white glazed articles. It forms an inert base on which dyes are precipitated to make lakes or colored paints. Ground barytes has also been used in making brick for the construction of X-ray laboratories, in place of a lining of sheet lead, to prevent the rays from escaping and doing possible injury.

Sales of ground barytes reported by producers in 1924 showed a slight decrease as compared with 1923. Sales in Missouri comprised nine-tenths of the total output of the country.

The Western Rock Products Co., of San Francisco, abandoned the operation of its plant, and Thompson, Weinman & Co. did not operate their plant in Kentucky during the year. The plant in St. Louis, formerly a part of the property of the Mineral Refining & Chemical Corporation, purchased in 1923 by the C. P. DeLore Co., took its place as an important producer.

Ground barytes sold by producers in the United States, 1918-1924

Year	Plants	Short tons	Value	
			Total	Average
1918	9	55,086	$1,041,608	$18.91
1919	9	[a] 57,985	1,163,437	20.06
1920	8	65,748	1,381,868	21.02
1921	7	27,661	622,871	22.52
1922	7	46,176	$933,722	$20.22
1923	6	39,605	895,095	22.60
1924	5	38,296	784,881	20.50

[a] Production, not sales.

The average value, at plant, of domestic ground barytes sold in the United States in 1924 was $20.50, compared with $22.60 in 1923. The quotation for western domestic floated ground barytes, as given in the Oil, Paint, and Drug Reporter, was $25 to $26 a ton at the beginning of the year; in the middle of January it dropped to $22 to $23 a ton, and remained at that figure throughout the year.

LITHOPONE

Lithopone, a pigment, is an intimate mixture by chemical precipitation of barium sulphate and zinc sulphide in the proportion of about 70 to 30, by weight. Though classed here as a barium product in order to fully exhibit the barium industry, it must be understood that lithopone is essentially a zinc pigment; and that, as shown by the investigations of the United States Tariff Commission in 1920, the cost of the zinc content of the pigment is one and a half times that of the barium content. Lithopone is exceedingly white, has a fine grain, and is used in inside paints and enamels and also as a filler in rubber goods, linoleum, oilcloth, window shades, and certain kinds of paper.

The lithopone industry continued its steady growth. Sales in 1924 were 11 per cent greater than in 1923 and marked the highest output yet reached. At the present time the manufacture of lithopone is confined to the Middle Atlantic States and Illinois. Two plants in Illinois reported their initial production—the reorganized Collinsville plant of the St. Louis Lithopone Co. and the Depue plant of the Mineral Point Zinc Co. The plant in Oakland, Calif., which was a producer for several years, ceased operations in 1923.

Lithopone sold by producers in the United States in 1924, by States

State	Plants	Short tons	Value	
			Total	Average
Pennsylvania and Delaware	3	54, 808	$6, 447, 791	$117. 64
New Jersey and Maryland	4	34, 341	3, 828, 810	111. 49
Illinois	4	20, 320	2, 254, 796	110. 96
	11	109, 469	12, 531, 397	114. 47

Lithopone sold by producers in the United States, 1918–1924

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average			Total	Average
1918	62, 403	$7, 923, 276	$126. 97	1922	83, 360	$9, 214, 040	$110. 53
1919	78, 365	10, 218, 850	130. 40	1923	98, 199	11, 608, 443	118. 21
1920	89, 373	12, 484, 925	139. 69	1924	109, 469	12, 531, 397	114. 47
1921	55, 016	6, 681, 563	121. 45				

The average value at the plant of lithopone sold in 1924 was $114.47 a ton, or $3.74 less than the average value in 1923. The quoted price of lithopone in New York, as given in the Oil, Paint, and Drug Reporter, was 6⅞ to 7 cents a pound at the opening of the year. There were some slight fluctuations in price during the first half of the year, but the quotation remained stationary at 6⅝ cents throughout the last half of the year.

BARIUM CHEMICALS

The manufacture of barium chemicals from barytes increased greatly during the World War and reached its height in 1918, when the sales amounted to 23,186 tons. The amount sold in 1919 and in 1920 was not far below that figure. Since the decided slump of 1921 the industry has been recovering, and sales in 1924 amounted to 18,154 tons, a gain of 8 per cent over sales in 1923.

Barium chemicals sold by producers in the United States, 1918–1924, in short tons

Chemical	1918–1920 (average)	1921	1922	1923	1924		
					Short tons	Value	
						Total	Average
Barium carbonate	7, 427	1, 956	2, 281	6, 362	6, 058	$411, 332	$67. 90
Barium chloride	4, 041	([a])	2, 022	3, 301	3, 859	297, 182	77. 01
Barium sulphate (blanc fixe)	7, 598	2, 471	7, 349	6, 761	7, 796	464, 152	59. 54
Other [b]	2, 254	1, 060	2, 249	379	441	41, 234	93. 50
	21, 320	5, 487	13, 901	16, 803	18, 154	1, 213, 900	66. 87

[a] Included under "Other."

[b] 1918 and 1920: Binoxide, hydroxide, nitrate, and sulphide; 1919: Binoxide, nitrate, and sulphide; 1921: Chloride, hydroxide, and sulphide; 1922: Binoxide, hydroxide, sulphide, and sulphydrate; 1923-24: Hydroxide and sulphide.

The average value of barium chemicals sold by producers in 1924 was $66.87 a ton—a decrease of $6.43 from the average of 1923. The decrease in barium carbonate was $1.49 a ton and in barium chloride $4.88 a ton.

Average quotations on barium chemicals at New York, 1922–1924 [a]

Chemical	Unit	1922	1923	1924
Barium carbonate	Short ton	$48. 00– $85. 00	$66. 00– $90. 00	$63. 00–$90. 00
Barium chlorate	Pound	. 14– . 45	. 14– . 15	. 14– . 15
Barium chloride	Short ton	50. 00– 115. 00	80. 00– 100. 00	70. 00– 95. 00
Barium dioxide	Pound	. 22– . 29	. 18– . 29	. 18– . 23
Barium nitrate	do	. 06– . 10¼	. 07½– . 10¼	. 08– . 10
Barium sulphate (blanc fixe), dry	do	. 04¼–	. 04¼–	. 04– . 05
Barium sulphate (blanc fixe), pulp	Short ton	40. 00– 50. 00	40. 00– 60. 00	50. 00– 70. 00
Barium binoxide	Pound	. 18– . 23	. 18– . 20	. 16– . 20

[a] Oil, Paint, and Drug Reporter.

The above quotations, taken from issues of the Oil, Paint, and Drug Reporter, represent the following grades and forms:

Barium carbonate, "bags."
Barium chlorate, "kegs."
Barium chloride, "crystals, bags."
Barium dioxide, "drums," listed under "Drugs and fine chemicals."
Barium nitrate, "casks."
Barium sulphate (blanc fixe), "dry, in barrels."
Barium binoxide, "drums," listed under "Industrial chemicals."

IMPORTS AND EXPORTS [3]

Germany has been the chief source of barytes and barium products imported into the United States. The World War naturally shut off this trade, and during 1918 a few hundred tons of ground witherite made up the total imports of barium in any form. Importation was resumed in a small way in 1919 but by 1922 was considerably greater than before the war, the imports of lithopone in particular being several times larger.

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[3] The statistics of imports and exports were compiled by J. A. Dorsey, of the Bureau Mines, from records of the Bureau of Foreign and Domestic Commerce.

Barium compounds imported for consumption in the United States, 1920–1924

[Value at port of shipment]

Year	Ground barytes			Lithopone			Barium binoxide		
	Short tons	Value		Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per pound		Total	Average per pound
1920	274	$3, 017	$11. 01	1, 714	$263, 240	$0. 077	251	$64, 447	$0. 128
1921	1, 002	16, 942	16. 91	5, 247	432, 019	. 041	669	127, 631	. 095
1922	4, 696	59, 453	12. 66	10, 763	885, 671	. 041	1, 009	189, 334	. 094
1923	6, 022	88, 741	14. 74	10, 440	776, 383	. 037	905	152, 270	. 084
1924	2, 830	38, 292	13. 53	6, 830	543, 025	. 040	860	120, 374	. 070

Year	Blanc fixe (precipitated barium sulphate)			Artificial barium carbonate (chemically precipitated)			Natural barium carbonate (ground witherite)		
	Short tons	Value		Short tons	Value		Short tons	Value	
		Total	Average per pound		Total	Average per pound		Total	Average per pound
1920	165	$8, 485	$0. 026	476	$37, 462	$0. 039	1, 510	$61, 284	$0. 020
1921	769	22, 470	. 015	2, 238	80, 603	. 018	668	25, 188	. 019
1922	2, 187	76, 445	. 017	5, 212	210, 250	. 020	1, 472	39, 114	. 013
1923	587	32, 063	. 027	1, 901	79, 482	. 021	1, 557	41, 823	. 013
1924	1, 047	50, 465	. 024	3, 752	128, 217	. 017	2, 500	56, 415	. 011

Year	Barium chloride			Barium nitrate			Barium hydroxide		
	Short tons	Value		Short tons	Value		Short tons	Value	
		Total	Average per pound		Total	Average per pound		Total	Average per pound
1920	1, 595	$151, 778	$0. 048	(a)			(a)		
1921	2, 186	72, 621	. 017	(a)			(a)		
1922	1, 962	112, 785	. 029	[b] 179	$16, 795	$0. 047	[b] 73	$6, 573	$0. 045
1923	1, 278	75, 014	. 029	511	59, 766	. 058	181	16, 872	. 047
1924	2, 330	100, 810	. 022	513	54, 638	. 053	174	8, 241	. 024

[a] Not separately enumerated prior to new tariff.
[b] Sept. 22 to Dec. 31; not separately enumerated prior to new tariff.

The exports of lithopone, which are considerably less than the imports, were not recorded separately by the Bureau of Foreign and Domestic Commerce prior to 1922. They amounted to 923 tons in 1924, a decrease of 38 per cent as compared with exports in 1923. More than 90 per cent of the exports went to Canada; the remainder was shipped in small amounts to a number of countries.

Lithopone exported from the United States, 1922–1924

Year	Short tons	Value
1922	1, 616	$169, 982
1923	1, 485	176, 624
1924	923	104, 783

MARKETS AND PRICES

The chief center for barytes consumption in the East is in the region near New York and Philadelphia, in which the prices are based on quotations at New York. In the Middle West barytes is consumed mainly about Chicago and St. Louis, where the prices are based on quotations at St. Louis, which is close to the barytes fields of Missouri. The prices of barium products are based on quotations at New York.

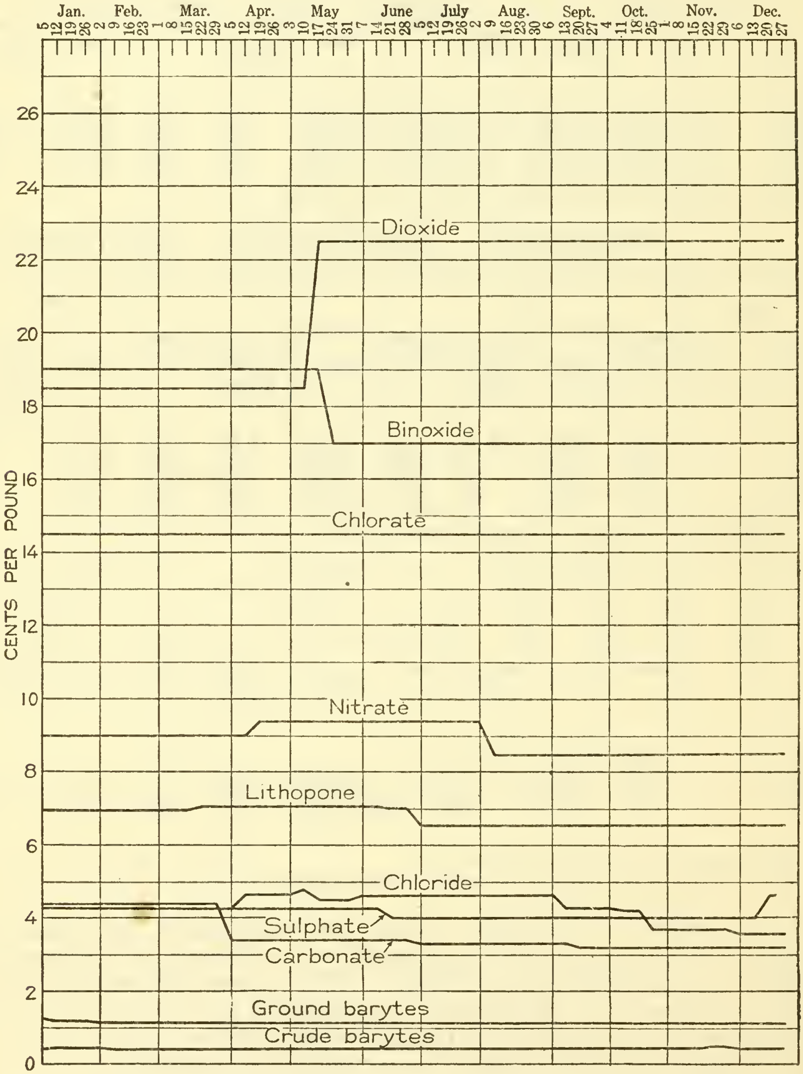

FIGURE 4.—Weekly quoted prices of crude barytes and of barium products, 1924

Figure 4 shows graphically the weekly quotations on crude barytes and the barium products. Quotations based on short tons have been reduced to prices per pound. The quotations on crude and ground barytes were taken from Chemical and Metallurgical Engineering; all others were taken from the Oil, Paint, and Drug Reporter.

CUSTOMS DUTIES

Mineral Resources for 1923 listed the duties levied on imports of barytes and barium compounds by the tariff act of 1922. On May 19, 1924, a proclamation by the President increased the duty on barium dioxide from 4 to 6 cents a pound—the new duty to go into effect 30 days later.

PRODUCERS

Producers of barium products in the United States active in 1924 are listed below, with the addresses of their main offices and the locations of their plants.

Ground barytes:	
Thompson, Weinman & Co., New York, N. Y.	Cartersville, Ga.
C. P. DeLore Co., St. Louis, Mo.	Mississippi River and River Des Peres, St. Louis, Mo.
National Pigments & Chemical Co., St. Louis, Mo.	St. Louis, Mo.
Point Milling & Manufacturing Co., Mineral Point, Mo.	Mineral Point, Mo.
Clinchfield Sand & Feldspar Co., Baltimore, Md.	Kings Creek, S. C.
Lithopone:	
Krebs Pigment & Chemical Co., Newport, Del.	Newport, Del.
Midland Chemical Co., Chicago, Ill.	Argo, Ill.
Mineral Point Zinc Co., care New Jersey Zinc Co., New York, N. Y.	Depue, Ill.
St. Louis Lithopone Co., St. Louis, Mo.	Collinsville, Ill.
Sherwin-Williams Co., Cleveland, Ohio	Chicago, Ill.
Chemical & Pigment Co., care The Glidden Co., Cleveland, Ohio	St. Helena, Md.
E. I. du Pont de Nemours & Co., Wilmington, Del.	Newark, N. J.
Do.	Philadelphia, Pa.
Grasselli Chemical Co., Cleveland, Ohio	Grasselli, N. J.
United Color & Pigment Co., Newark, N. J.	Newark, N. J.
New Jersey Zinc Co. (of Pennsylvania) New York, N. Y.	Palmerton, Pa.
Barium chemicals:[4]	
Basic Chemical Manufacturing Corporation, Alton, Ill.	Federal, Ill.
Chicago Copper & Chemical Co., Chicago, Ill.	Blue Island, Ill.
Titanium Pigment Co. (Inc.), New York, N. Y.	Carondelet Station, St. Louis, Mo.
Do.	Niagara Falls, N. Y.
Grasselli Chemical Co., Cleveland, Ohio	Grasselli, N. J.
E. I. du Pont de Nemours & Co., Wilmington, Del.	Philadelphia, Pa.
Bertha Mineral Co., care New Jersey Zinc Co., New York, N. Y.	Sweetwater, Tenn.
Barium Mining Corporation, New York, N. Y.	Charleston, W. Va.

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[4] Includes only those using barytes ore.

NATURAL GAS

By G. B. Richardson and H. Backus

In 1924 the natural-gas industry in the United States made another high record by the consumption of 1,141,482,000,000 cubic feet, which had an estimated value of $105,779,000 at the wells and of $253,830,000 at points of consumption. This total is 13 per cent more than the consumption in 1923 and almost double that of 1914.

Increased production, as measured by deliveries to consumers, is recorded for most of the States and in California, Louisiana, and Texas the gains range between 58 and 33 billion cubic feet; but on the other hand a smaller output than in 1923 is reported from West Virginia, Pennsylvania, Ohio, and Montana. West Virginia passed from first place in quantity of gas produced, a rank it had held since 1909, to third place, and Pennsylvania receded from fourth to sixth place. These changes mark the passing supremacy of the Eastern States in the production of natural gas and a closer approach in rank of the States producing natural gas to those that produce petroleum, and they emphasize the increasing use of casing-head gas—the gas obtained from oil wells.

The ratio of the domestic to the total consumption of natural gas continued to decrease and in 1924 only 25 per cent of the total quantity was used for domestic purposes as contrasted with 28 per cent in 1923, with 33 per cent in 1922, and with 38 per cent in 1921. Nevertheless, the total quantity of natural gas utilized by domestic consumers in 1924 increased 3 per cent and the number of domestic consumers in 1924 increased 209,600 to the record of 3,443,400.

The value at points of consumption of the natural gas utilized for domestic purposes was considerably more than the value of the natural gas that was consumed industrially, although the volume of the latter was three times as much as that of the former. The average value of the natural gas consumed for domestic purposes in 1924 ranged from 29.6 cents per 1,000 cubic feet in West Virginia to 91.2 cents in Missouri, and for the United States it increased to the record high of 54 cents, as contrasted with 51.4 cents in 1923 and with 38.2 cents in 1920. The average value of the natural gas consumed for industrial purposes in 1924 ranged from 2.6 cents in Colorado to 53.2 cents in Maryland and for the United States averaged 11.6 cents per 1,000 cubic feet.

The quantity of natural gas reported as treated for recovery of natural-gas gasoline in 1924 was 1,016,276,000,000 cubic feet. This is equivalent to 89 per cent of the total consumption of natural gas in the United States and contrasts with 87 per cent in 1923, 71 per cent in 1922, and 62 per cent in 1920. The growth not only shows increasing conservation of natural gas but indicates the near approach of the time when the available annual supply of gas, which until 1923 had been greatly in excess of the quantity treated for the recovery of gasoline, will be a controlling factor in the growth of the natural-gas gasoline industry.

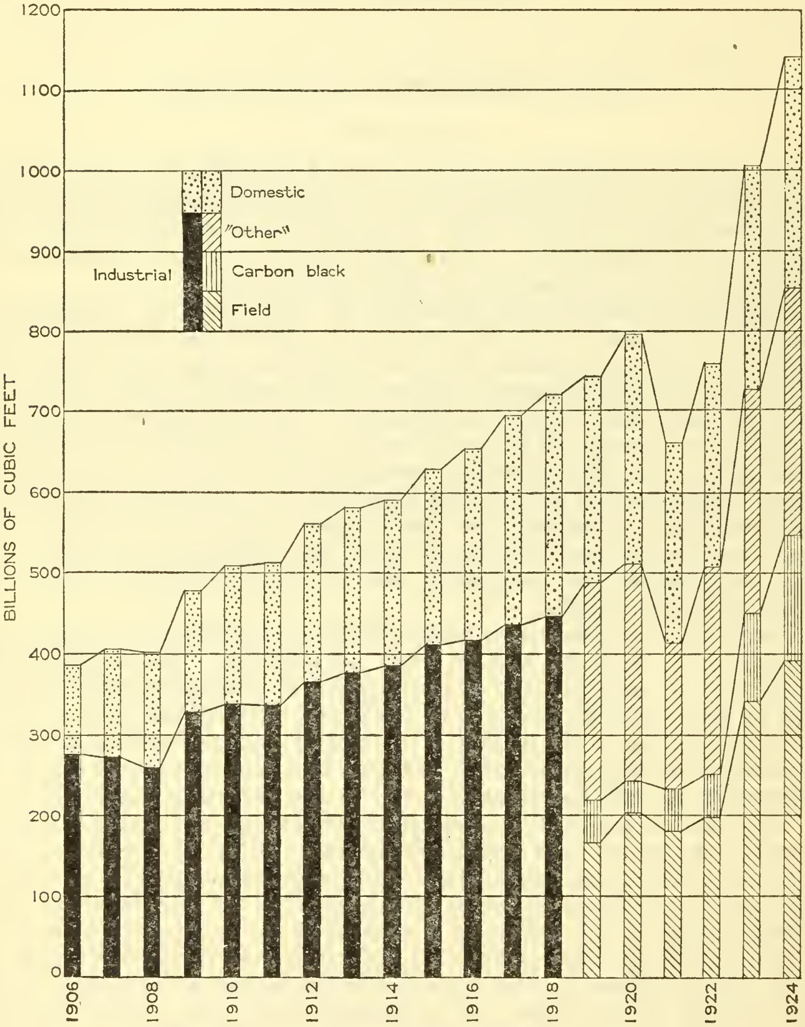

FIGURE 5.—Consumption of natural gas, 1906–1924, by uses

In 1924 a total of 156,514,000,000 cubic feet of natural gas was reported as consumed in the production of carbon black in the United States. This total is equivalent to 14 per cent of the total consumption of natural gas, and is almost three times the quantity consumed in the manufacture of carbon black in 1922.

Summary of statistics for natural gas in the United States, 1920–1924

	1920	1921	1922	1923	1924
Natural gas consumed:					
Domestic … millions of cubic feet	286, 001	248, 334	254, 413	[a]277, 050	285, 152
Industrial—					
Carbon black … do	40, 599	50, 565	53, 629	109, 096	156, 514
Field … do	202, 108	182, 305	197, 850	343, 076	393, 437
Other industrial … do	269, 502	180, 848	256, 654	277, 745	306, 379
	798, 210	662, 052	762, 546	[a]1,006,967	1, 141, 482
Domestic … per cent	35. 8	37. 5	33. 4	27. 5	25
Industrial … do	64. 2	62. 5	66. 6	72. 5	75
Treated for natural-gas gasoline:					
Millions of cubic feet	496, 431	465, 097	545, 139	875, 711	1, 016, 276
Per cent of total consumption	62. 2	70. 3	71. 5	87. 0	89
Domestic consumers … thousands	2, 615	2, 631	3, 015	3, 234	3, 443
Value of natural gas at wells:					
Total … thousands of dollars	([b])	([b])	84, 873	[a]100, 849	105, 779
Average per M cubic feet … cents	([b])	([b])	11. 1	10. 0	9. 3
Value of natural gas at points of consumption:					
Total … thousands of dollars	196, 194	174, 617	221, 535	[a]239, 995	253, 830
Domestic … do	109, 302	110, 337	126, 902	[a]142, 317	154, 075
Industrial … do	86, 892	64, 280	94, 633	97, 678	99, 755
Average per M cubic feet—					
Domestic … cents	38. 2	44. 4	49. 9	[a]51. 4	54. 0
Industrial … do	17. 0	15. 5	18. 6	13. 4	11. 6
Domestic and industrial … do	24. 6	26. 4	29. 1	23. 8	22. 2
By-products of natural gas:					
Natural-gas gasoline (raw)—					
Quantity … thousands of gallons	384, 744	449, 934	505, 832	816, 226	933, 861
Value at plants—					
Total … thousands of dollars	71, 788	61, 815	72, 711	77, 268	82, 233
Average per gallon … cents	18. 7	13. 7	14. 4	9. 5	8. 8
Carbon black—					
Quantity … thousands of pounds	51, 322	59, 766	67, 795	138, 263	186, 872
Value at plants—					
Total … thousands of dollars	4, 032	5, 446	5, 820	11, 692	11, 565
Average per pound … cents	7. 9	9. 1	8. 6	8. 5	6. 2

[a] Revised figures.
[b] Figures not available.

Natural gas produced and consumed in the United States, 1923–24

State	Produced and delivered to consumers, including deliveries in other States						Consumed, including receipts from other States			
	Quantity		Estimated value at the wells		Value at points of consumption		Quantity		Value at points of consumption	
	M cubic feet	Per cent of total	Total	Average per M cubic feet (cents)	Total	Average per M cubic feet (cents)	M cubic feet	Per cent of total	Total	Average per M cubic feet (cents)
1923										
Ark	24,215,000	2.4	$990,000	4.1	$3,255,000	13.4	33,746,000	3.4	$4,536,000	13.4
Calif	131,434,000	13.1	8,543,000	6.5	22,787,000	17.3	131,434,000	13.1	22,787,000	17.3
Colo	800	(a)	80	10.0	400	50.0	800	(a)	400	50.0
Ill	4,049,000	.4	587,000	14.5	690,000	17.0	4,049,000	.4	690,000	17.0
Ind	880,000	.1	286,000	32.5	460,000	52.3	2,951,000	.3	1,553,000	52.6
Kans	[b] 30,913,000	3.1	[b] 2,597,000	8.4	[b] 11,249,000	[b] 36.4	37,637,000	3.7	10,829,000	28.8
Ky	11,953,000	1.2	1,039,000	8.7	3,156,000	26.4	21,232,000	2.1	5,605,000	26.4
La	112,031,000	11.1	2,890,000	2.6	6,022,000	5.4	111,434,000	11.1	5,127,000	4.6
Md	----------	----	----------	------	----------	------	668,000	.1	486,000	72.8
Mich	700	(a)	80	11.4	320	45.7	700	(a)	320	45.7
Mo	17,000	(a)	3,000	17.6	[b] 14,000	[b] 82.4	[b] 5,142,000	.5	[b] 4,187,000	[b] 81.4
Mont	1,470,000	.2	59,000	4.0	317,000	21.6	2,417,000	.2	521,000	21.6
N. Y	6,497,000	.6	1,648,000	25.4	3,739,000	57.5	16,495,000	1.6	9,506,000	57.6
Ohio	53,812,000	5.3	8,395,000	15.6	25,675,000	47.7	120,920,000	12.0	58,468,000	48.4
Okla	203,082,000	20.2	18,277,000	9.0	[b] 31,214,000	[b] 15.4	173,788,000	17.3	24,631,000	14.2
Pa	112,562,000	11.2	25,887,000	23.0	45,873,000	40.8	138,478,000	13.8	54,742,000	39.5
S. Dak	33,000	(a)	3,000	9.1	16,600	50.3	33,000	(a)	16,600	50.3
Tenn	4,100	(a)	300	7.3	1,000	24.4	4,100	(a)	1,000	24.4
Tex	[c] 74,535,000	7.4	3,809,000	5.1	11,320,000	15.2	[b] 83,037,000	8.2	[b] 13,757,000	16.6
W. Va	203,867,000	20.2	24,403,000	12.0	69,981,000	34.3	88,827,000	8.8	18,525,000	20.9
Wyo	35,523,000	3.5	1,424,000	4.0	4,222,000	11.9	34,576,000	3.4	4,018,000	11.6
Other [d]	97,400	(a)	8,540	8.8	8,680	8.9	97,400	(a)	8,680	8.9
	[b] 1,006,976,000	100.0	[b] 100,849,000	10.0	[b] 240,001,000	23.8	[b] 1,006,967,000	100.0	[b] 239,995,000	23.8
1924										
Ark	36,616,000	3.2	1,747,000	4.8	4,908,000	13.4	44,595,000	3.9	5,977,000	13.4
Calif	189,692,000	16.6	14,227,000	7.5	35,949,000	19.0	189,692,000	16.6	35,949,000	19.0
Colo	47,600	(a)	1,700	3.6	1,700	3.6	47,600	(a)	1,700	3.6
Ill	4,072,000	.4	635,000	15.6	759,000	18.6	4,072,000	.4	759,000	18.6
Ind	998,000	.1	357,190	35.8	494,000	49.5	2,377,000	.2	1,278,000	53.8
Kans	25,580,000	2.2	2,128,000	8.3	10,087,000	39.4	40,528,000	3.5	11,074,000	27.3
Ky	12,875,000	1.1	1,147,000	8.9	3,432,000	26.7	21,514,000	1.9	5,841,000	27.1
La	160,945,000	14.1	5,021,000	3.1	7,626,000	4.7	163,469,000	14.3	6,858,000	4.2
Md	----------	----	----------	------	----------	------	679,000	.1	496,000	73.0
Mich	600	(a)	55	9.2	300	50.0	600	(a)	300	50.0
Mo	71,000	(a)	6,525	9.2	61,000	85.9	5,394,000	.5	4,617,000	85.6
Mont	1,071,000	.1	34,380	3.2	272,350	25.4	2,228,000	.2	566,350	25.4
N. Y	[e] 6,196,000	.5	1,853,000	29.9	3,632,000	58.6	16,506,000	1.4	9,685,000	58.7
Ohio	47,396,000	4.2	8,351,000	17.6	24,203,000	51.1	111,353,000	9.8	57,550,000	51.7
Okla	214,452,000	18.8	14,926,000	7.0	31,045,700	14.5	183,451,000	16.1	24,016,700	13.1
Pa	105,863,000	9.3	25,037,000	23.7	45,546,000	43.0	123,932,000	10.9	52,005,000	42.0
S. Dak	3,000	(a)	275	9.2	2,500	83.3	3,000	(a)	2,500	83.3
Tenn	1,200	(a)	110	9.2	450	37.5	1,200	(a)	450	37.5
Tex	[f] 107,247,000	9.4	4,065,000	3.8	13,748,000	12.8	107,447,000	9.4	14,914,000	13.9
W. Va	182,285,000	16.0	24,536,000	13.5	68,000,000	37.3	79,240,000	6.9	18,445,000	23.3
Wyo	46,036,000	4.0	1,699,000	3.7	4,081,000	8.9	44,879,000	3.9	3,787,000	8.4
Other [d]	73,600	(a)	6,765	9.2	7,000	9.5	73,600	(a)	7,000	9.5
	1,141,521,000	100.0	105,779,000	9.3	253,856,000	22.2	1,141,482,000	100.0	253,830,000	22.2

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[a] Less than 0.1 per cent.

[b] Revised figures.

[c] Includes 9,000 M cubic feet consumed in Mexico.

[d] 1923: Alaska, Iowa, New Mexico, and North Dakota; 1924: Alaska, Iowa, and North Dakota.

[e] Includes 12,000 M cubic feet consumed in Canada.

[f] Includes 27,000 M cubic feet consumed in Mexico.

Interstate transportation of natural gas, 1923–24

State in which gas was produced	State to which gas was transported	M cubic feet
1923		
Indiana	Kentucky	12,000
Kansas	Missouri	[a] 4,566,000
	Oklahoma	337,000
		[a] 4,903,000
Louisiana	Arkansas	7,625,000
	Texas	1,615,000
		9,240,000
New York	Pennsylvania	34,000
Ohio	Indiana	2,083,000
	West Virginia	1,579,000
		3,662,000
Oklahoma	Arkansas	1,906,000
	Kansas	11,627,000
	Missouri	559,000
	Texas	15,539,000
		29,631,000
Pennsylvania	New York	10,032,000
	Ohio	67,000
	West Virginia	2,381,000
		12,480,000
Texas	Louisiana	8,643,000
	Mexico	9,000
		8,652,000
West Virginia	Kentucky	9,267,000
	Maryland	668,000
	Ohio	70,703,000
	Pennsylvania	38,362,000
		119,000,000
Wyoming	Montana	947,000
		[a]188,561,000

State in which gas was produced	State to which gas was transported	M cubic feet
1924		
Indiana	Kentucky	157,000
Kansas	Missouri	5,323,000
	Oklahoma	34,000
		5,357,000
Kentucky	West Virginia	1,678,000
Louisiana	Arkansas	6,908,000
	Texas	2,453,000
		9,361,000
New York	Canada	12,000
	Pennsylvania	24,000
		36,000
Ohio	Indiana	1,536,000
	West Virginia	1,149,000
		2,685,000
Oklahoma	Arkansas	705,000
	Kansas	20,305,000
	Texas	10,025,000
		31,035,000
Pennsylvania	Ohio	85,000
	New York	10,346,000
	West Virginia	3,289,000
		13,720,000
Texas	Arkansas	366,000
	Louisiana	11,885,000
	Mexico	27,000
		12,278,000
West Virginia	Kentucky	10,160,000
	Maryland	679,000
	Ohio	66,557,000
	Pennsylvania	31,765,000
		109,161,000
Wyoming	Montana	1,157,000
		186,625,000

[a] Revised figures.

Natural gas consumed in the United States, 1923–24

State	Domestic				Industrial							
	Number of consumers	M cubic feet	Value at points of consumption		Field (drilling, pumping, and operating gasoline recovery plants)		Other industrial, including use in manufacture of carbon black			Total industrial		
			Total	Average (cents)	M cubic feet (estimated)	Value at points of consumption (estimated)	M cubic feet	Value at points of consumption		M cubic feet	Value at points of consumption	
								Total	Average (cents)		Total	Average (cents)
1923												
Arkansas	38, 280	5, 670, 000	$2, 105, 000	37. 1	18, 320, 000	$749, 000	9, 756, 000	$1, 682, 000	17. 2	28, 076, 000	$2, 431, 000	8. 7
California	511, 590	16, 642, 000	12, 525, 000	75. 3	86, 101, 000	5, 596, 000	28, 691, 000	4, 666, 000	16. 3	114, 792, 000	10, 262, 000	8. 9
Colorado	8	800	400	50. 0	------------	------------	------------	------------	--------	------------	------------	--------
Illinois [a]	10, 500	216, 000	134, 000	62. 0	3, 833, 000	556, 000	------------	------------	--------	3, 833, 000	556, 000	14. 5
Indiana	36, 300	1, 624, 000	936, 000	57. 6	47, 000	15. 000	1, 280, 000	602, 000	47. 0	1, 327, 000	617, 000	46. 5
Kansas	130, 830	10, 462, 000	6, 302, 000	60. 2	4, 844, 000	409, 000	22, 331, 000	4, 118, 000	18. 4	27, 175, 000	4, 527, 000	16. 7
Kentucky	116, 570	10, 897, 000	4, 328, 000	39. 7	1, 193, 000	104, 000	9, 142, 000	1, 173, 000	12. 8	10, 335, 000	1, 277, 000	12. 4
Louisiana	26, 730	3, 264, 000	1, 020, 000	31. 3	13, 880, 000	358, 000	94, 290, 000	3, 749, 000	4. 0	108, 170, 000	4, 107, 000	3. 8
Maryland	11, 290	587, 000	443, 000	75. 5	------------	------------	81, 000	43, 000	53. 1	81, 000	43, 000	53. 1
Michigan	10	700	320	45. 7	------------	------------	------------	------------	--------	------------	------------	--------
Missouri	93, 070	[b] 4, 883, 000	[b] 4, 091, 440	[b] 83. 8	------------	------------	259, 000	95, 560	36. 9	259, 000	95, 560	36. 9
Montana	5, 170	1, 083, 000	482, 000	44. 5	520, 000	20, 000	814, 000	19, 000	2. 3	1, 334, 000	39, 000	2. 9
New York	197, 540	16, 009, 000	9, 300, 000	58. 1	217, 000	55, 000	269, 000	151, 000	56. 1	486, 000	206, 000	42. 4
Ohio	1, 023, 730	91, 702, 000	46, 553, 000	50. 8	4, 714, 000	735, 000	24, 504, 000	11, 180, 000	45. 6	29, 218, 000	11, 915, 000	40. 8
Oklahoma	142, 700	17, 496, 000	8, 436, 000	48. 2	114, 948, 000	10, 345, 000	41, 344, 000	5, 850, 000	14. 1	156, 292, 000	16, 195, 000	10. 4
Pennsylvania	548, 440	58, 968, 000	29, 614, 000	50. 2	10, 027, 000	2, 304, 000	69, 483, 000	22, 824, 000	32. 8	79, 510, 000	25, 128, 000	31. 6
South Dakota	380	33, 000	16, 600	50. 3	------------	------------	------------	------------	--------	------------	------------	--------
Tennessee	2	100	60	60. 0	------------	------------	4, 000	940	23. 5	4, 000	940	23. 5
Texas	177, 070	13, 002, 000	8, 406, 000	64. 7	51, 876, 000	2, 651, 000	18, 159, 000	2, 700, 000	14. 9	70, 035, 000	5, 351, 000	7. 6
West Virginia	154, 060	22, 806, 000	6, 884, 000	30. 2	20, 252, 000	2, 424, 000	45, 769, 000	9, 217, 000	20. 1	66, 021, 000	11, 641, 000	17. 6
Wyoming	9, 350	1, 632, 000	734, 000	45. 0	12, 279, 000	493, 000	20, 665, 000	2, 791, 000	13. 5	32, 944, 000	3, 284, 000	10. 0
Other [c]	180	72, 400	6, 180	8. 5	25, 000	2, 500	------------	------------	--------	25, 000	2, 500	10. 0
	3, 233, 800	[b] 277, 050, 000	[b] 142, 317, 000	[b] 51. 4	343, 076, 000	26, 816, 500	386, 841, 000	70, 861, 500	18. 3	729, 917, 000	97, 678, 000	13. 4

1924												
Arkansas	44, 930	6, 346, 000	2, 744, 000	43. 2	28, 180, 000	1, 344, 000	10, 069, 000	1, 889, 000	18. 8	38, 249, 000	3, 233, 000	8. 5
California	591, 010	22, 480, 000	16, 619, 000	73. 9	108, 660, 000	8, 150, 000	58, 552, 000	11, 180, 000	19. 1	167, 212, 000	19, 330, 000	11. 6
Colorado	9	900	500	55. 6			46, 700	1, 200	2. 6	46, 700	1, 200	2. 6
Illinois	10, 610	260, 000	164, 000	63. 1	3, 812, 000	595, 000				3, 812, 000	595, 000	15. 6
Indiana	25, 980	1, 194, 000	729, 000	61. 1	84, 600	30, 000	1, 098, 400	519, 000	47. 3	1, 183, 000	549, 000	46. 4
Kansas	135, 420	9, 876, 000	6, 362, 000	64. 4	5, 911, 000	492, 000	24, 741, 000	4, 220, 000	17. 1	30, 652, 000	4, 712, 000	15. 4
Kentucky	129, 140	11, 230, 000	4, 590, 000	40. 9	1, 002, 000	89, 000	9, 282, 000	1, 162, 000	12. 5	10, 284, 000	1, 251, 000	12. 2
Louisiana	30, 430	4, 523, 000	1, 404, 000	31. 0	18, 073, 000	564, 000	140, 873, 000	4, 890, 000	3. 5	158, 946, 000	5, 454, 000	3. 4
Maryland	11, 710	602, 000	455, 000	75. 6			77, 000	41, 000	53. 2	77, 000	41, 000	53. 2
Michigan	7	600	300	50. 0								
Missouri	93, 032	4, 860, 000	4, 431, 000	91. 2			534, 000	186, 000	34. 8	534, 000	186, 000	34. 8
Montana	5, 640	1, 319, 000	540, 300	41. 0	239, 000	7, 650	670, 000	18, 400	2. 7	909, 000	26, 050	2. 9
New York	213, 790	15, 964, 000	9, 471, 000	59. 3	306, 000	91, 000	236, 000	123, 000	52. 1	542, 000	214, 000	39. 5
Ohio	1, 065, 860	88, 269, 000	48, 301, 000	54. 7	4, 752, 000	838, 000	18, 332, 000	8, 411, 000	45. 9	23, 084, 000	9, 249, 000	40. 1
Oklahoma	150, 170	17, 184, 000	9, 115, 700	53. 0	118, 774, 000	8, 266, 600	47, 493, 000	6, 634, 400	14. 0	166, 267, 000	14, 901, 000	9. 0
Pennsylvania	568, 200	58, 896, 000	31, 732, 000	53. 9	9, 494, 000	2, 245, 000	55, 542, 000	18, 028, 000	32. 5	65, 036, 000	20, 273, 000	31. 2
South Dakota	52	3, 000	2, 500	83. 3								
Tennessee	32	800	400	50. 0	400	50				400	50	12. 5
Texas	196, 560	14, 708, 000	9, 067, 000	61. 6	61, 155, 000	2, 318, 000	31, 584, 000	3, 529, 000	11. 2	92, 739, 000	5, 847, 000	6. 3
West Virginia	160, 210	24, 943, 000	7, 381, 000	29. 6	12, 962, 000	1, 745, 000	41, 335, 000	9, 319, 000	22. 5	54, 297, 000	11, 064, 000	20. 4
Wyoming	10, 603	2, 492, 100	965, 000	38. 7	19, 959, 000	737, 000	22, 427, 900	2, 085, 000	9. 3	42, 386, 900	2, 822, 000	6. 7
Other [d]	5	600	300	50. 0	73, 000	6, 700				73, 000	6, 700	9. 2
	3, 443, 400	285, 152, 000	154, 075, 000	54. 0	393, 437, 000	27, 519, 000	462, 893, 000	72, 236, 000	15. 6	856, 330, 000	99, 755, 000	11. 6

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[a] Gas used with manufactured gas.

[b] Revised figures.

[c] Alaska, Iowa, New Mexico, and North Dakota.

[d] Alaska, Iowa, and North Dakota.

Rank of States in production and consumption of natural gas, 1919–1924

State	Utilized production						Consumption					
	1919	1920	1921	1922	1923	1924	1919	1920	1921	1922	1923	1924
Alaska					18	16					20	18
Arkansas	11	10	12	10	10	9	10	10	12	10	10	9
California	5	4	4	4	3	2	5	5	5	4	3	1
Colorado	18	18	18	17	21	18	20	20	20	19	22	19
Illinois	12	13	13	13	13	13	15	15	15	14	14	14
Indiana	14	14	14	14	15	15	14	14	14	15	15	15
Iowa	22	21	21	22	24	22	23	22	22	23	25	23
Kansas	8	8	8	9	9	10	6	8	8	8	8	10
Kentucky	13	12	11	12	11	11	11	11	11	12	11	11
Louisiana	6	6	5	5	5	4	8	7	6	6	5	3
Maryland	23	23	23				17	17	16	16	17	17
Michigan	21	22	22	20	22	21	22	23	23	21	23	22
Missouri	19	19	18	19	19	17	13	13	13	13	13	13
Montana	15	15	15	15	14	14	16	16	17	17	16	16
New Mexico					16						18	
New York	9	11	10	11	12	12	9	9	10	11	12	12
North Dakota	20	20	20	21	23	23	21	21	21	22	24	24
Ohio	4	5	6	6	7	7	2	2	1	2	4	5
Oklahoma	2	2	2	2	2	1	3	3	2	3	1	2
Oregon	23	23	23				24	24	24			
Pennsylvania	3	3	3	3	4	6	1	1	3	1	2	4
South Dakota	17	16	17	16	17	19	19	18	19	18	19	20
Tennessee	16	17	16	18	20	20	18	19	18	20	21	21
Texas	7	7	7	7	6	5	7	6	7	7	7	6
West Virginia	1	1	1	1	1	3	4	4	4	5	6	7
Wyoming	10	9	9	8	8	8	12	12	9	9	9	8

Statistics of natural gas in the United States, 1914–1924

Year	Produced and delivered to consumers (billions of cubic feet)	Treated for recovery of natural-gas gasoline		Domestic consumption			
		Billions of cubic feet	Per cent of total consumption	Number of consumers (thousands)	Billions of cubic feet	Per cent of total consumption	Average value at points of consumption per M cubic feet (cents)
1914	592	17	3	2,078	203	34	28.0
1915	629	24	4	2,195	217	35	28.3
1916	753	209	28	2,362	235	31	28.6
1917	795	429	54	2,431	258	32	30.8
1918	721	449	62	2,509	271	38	31.4
1919	746	480	64	2,501	256	34	34.6
1920	798	496	62	2,615	286	36	38.2
1921	662	465	70	2,631	248	38	44.4
1922	763	545	71	3,015	255	33	49.9
1923	[a] 1,007	876	87	3,234	[a] 277	28	[a] 51.4
1924	1,142	1,016	89	3,443	285	25	54.0

[a] Revised figures.

Statistics of natural gas in the United States, 1914–1924—Continued

Year	Industrial consumption					
	Field (billions of cubic feet)	Carbon black (billions of cubic feet)	Other industrial (billions of cubic feet)	Total industrial (billions of cubic feet)	Per cent of total consumption	Average value at points of consumption per M cubic feet (cents)
1914	([a])	([a])	([a])	389	66	9.6
1915	([a])	([a])	([a])	412	65	9.7
1916	([a])	([a])	([a])	518	69	10.2
1917	([a])	([a])	([a])	537	68	11.7
1918	([a])	([a])	([a])	450	62	15.2
1919	170	50	270	490	66	14.8
1920	202	41	269	512	64	17.0
1921	182	51	181	414	62	15.5
1922	198	54	256	508	67	18.6
1923	343	109	278	730	72	13.4
1924	393	157	306	856	75	11.6

[a] Figures not available.

Natural gas produced in the United States and delivered to consumers, 1914–1924, in millions of cubic feet

Year	Arkansas	California	Illinois	Indiana	Kansas	Kentucky	Louisiana	Montana	New York	Ohio
1914	[a] 963	17,829	3,548	2,580	22,628	1,422	[b] 26,775	--------	8,935	68,270
1915	[c] 992	21,891	2,690	2,261	27,046	1,667	25,540	6	7,977	79,510
1916	2,388	31,643	3,534	1,715	31,710	2,107	32,081	213	8,036	69,888
1917	5,610	49,427	4,439	1,712	24,439	2,802	31,287	334	8,372	68,917
1918	5,295	39,719	4,473	1,667	27,825	3,022	36,094	177	8,461	61,261
1919	5,587	55,607	3,825	1,407	16,150	2,057	47,062	858	8,124	63,153
1920	9,027	66,041	3,013	1,779	21,158	3,345	58,274	818	8,419	58,938
1921	4,260	75,942	2,646	1,066	15,717	4,820	58,004	336	6,583	47,412
1922	9,700	84,580	3,383	947	20,289	5,872	70,267	486	6,947	51,481
1923	24,215	131,434	4,049	880	[d] 30,913	11,953	112,031	1,470	6,497	53,812
1924	36,616	189,692	4,072	998	25,580	12,875	160,945	1,071	6,196	47,396

Year	Oklahoma	Pennsylvania	Texas	West Virginia	Wyoming	Others	Total	Value at points of consumption	
								Total (thousands of dollars)	Average per M cubic feet (cents)
1914	78,167	110,745	13,434	236,489	([a])	82	591,867	94,116	15.9
1915	87,517	113,692	13,324	244,004	[e] 342	120	628,579	101,312	16.1
1916	123,517	130,484	15,810	299,319	[e] 575	150	753,170	120,227	16.0
1917	137,384	133,397	17,047	308,617	[e] 1,223	103	795,110	142,089	17.9
1918	124,317	123,813	13,440	265,161	4,339	1,937	721,001	153,554	21.3
1919	163,649	113,489	24,710	234,095	6,014	129	745,916	160,888	21.6
1920	154,467	125,787	37,063	239,719	10,312	50	798,210	196,194	24.6
1921	124,058	86,144	44,504	174,921	15,608	31	662,052	174,617	26.4
1922	140,631	101,276	47,945	195,288	23,427	27	762,546	221,535	29.1
1923	203,082	112,562	74,535	203,867	35,523	153	[d] 1,006,976	[d] 240,001	23.8
1924	214,452	105,863	107,247	182,285	46,036	197	1,141,521	253,856	22.2

[a] Colorado and Wyoming included with Arkansas.
[b] Alabama included with Louisiana.
[c] Includes gas piped from Oklahoma and consumed in Arkansas.
[d] Revised figures.
[e] Includes Colorado.

NATURAL-GAS GASOLINE

By G. B. Richardson and E. M. Seeley

The production of raw (unblended) natural-gas gasoline in the United States in 1924 was 933,861,000 gallons, an increase of 117,635,000 gallons over the output in 1923. This total is based on reports by 457 producers operating 1,096 plants in 13 States. Of the total production 89,495,000 gallons were run into crude-petroleum pipe lines and mixed with the oil that goes to refineries to be distilled; the remainder (excepting losses and the relatively small quantity utilized in the raw state) was blended for use as motor fuel.

Increased output was reported in all of the producing States except West Virginia, Ohio, and Kentucky, in which small losses were recorded. The greatest gain was in California, where the increase was 59,250,000 gallons, or 34 per cent. The output of the three leading States—Oklahoma, California, and Texas—amounted to 77 per cent of the total production of the country.

The dominating position of the industry in the States west of Mississippi River is shown by the fact that 89 per cent of the total output of natural-gas gasoline in the United States in 1924 was produced in that area, although 45 per cent of all the plants are in States east of the Mississippi.

The tendency to utilize a combination of processes for recovering gasoline from natural gas is increasing. Many compression plants have been remodeled to utilize the absorption process, and the new charcoal process is being used not only by itself but also in auxiliary plants to treat the discharge gas of plants utilizing the compression and absorption processes. The plants reported as utilizing the compression process singly (not in combination with other processes) in 1924 numbered 639; they produced 257,894,000 gallons—an average of 403,590 gallons per plant per annum. The 445 plants reported to have used the oil-absorption process, either singly or in combination with the compression or charcoal process, produced 670,678,000 gallons—an average of 1,507,142 gallons per plant per annum. Reports were received from 12 plants in which only the charcoal process was utilized; they produced 4,064,000 gallons. Five plants were reported to have utilized the charcoal process in combination with other processes in recovering gasoline from natural gas.

In 1924 producers reported treating approximately 1,016,276,000,000 cubic feet of natural gas in the recovery of natural-gas gasoline, a quantity equivalent to 89 per cent of the total consumption of natural gas in the United States in that year. This contrasts with 87 per cent in 1923, 71 per cent in 1922, and with

54 per cent in 1917. The relationship between the total quantity of natural gas consumed in the United States and the quantity treated for the recovery of natural-gas gasoline for the years 1911–1924 is shown in Figure 6. The statistics show not only the increasing conservation of natural gas but indicate the near approach of the time when the available annual supply of gas, which until 1923 was greatly in excess of the quantity treated for the recovery of gasoline, will be a controlling factor in the growth of the industry.

The approximate quantity of motor fuel produced in the United States can be computed by combining figures showing the production of gasoline at petroleum refineries (including naphthas and other products lighter than kerosene) and figures showing the production of benzol by the coke industry with figures showing the production of raw natural-gas gasoline, making allowance for the raw natural-gas gasoline reported as blended at petroleum refineries and the raw natural-gas gasoline which is run into crude-petroleum pipe lines and mixed with the oil that goes to refineries to be distilled. This has been done for the years 1918–1924, as shown in Figure 7.

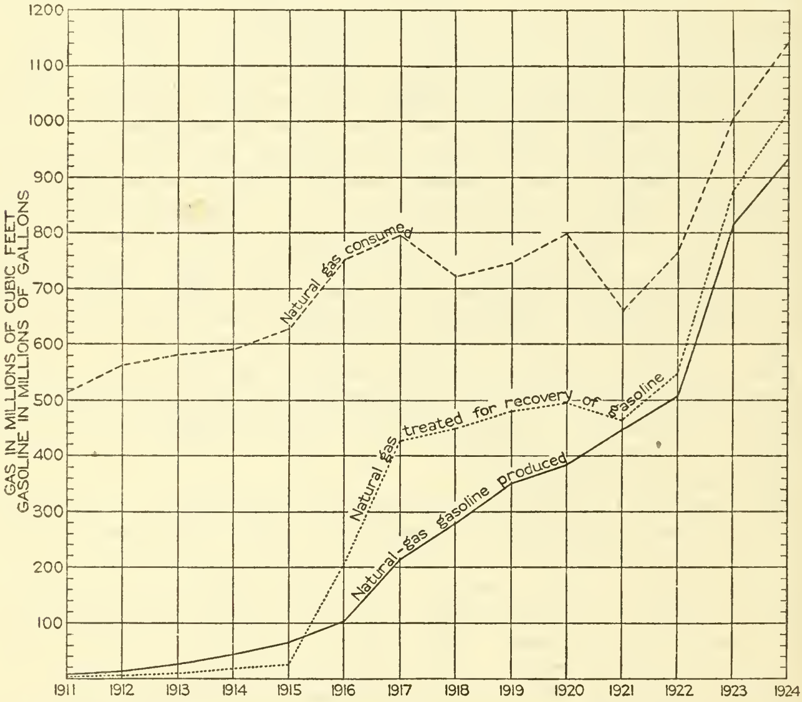

FIGURE 6.—Natural gas consumed, natural gas treated for recovery of gasoline, and natural-gas gasoline produced in the United States, 1911–1924

The ratio of the production of raw natural-gas gasoline to the total motor fuel produced has increased from 7 per cent in 1918 to 10 per cent in 1924. Data compiled in 1925 indicate that approximately 25 per cent of the motor fuel produced is made by cracking processes.

Apparently, therefore, about 64 per cent of the total output of motor fuel comes from "straight-run" processes of manufacture from petroleum, 10 per cent from raw natural-gas gasoline, and about 1 per cent from benzol.

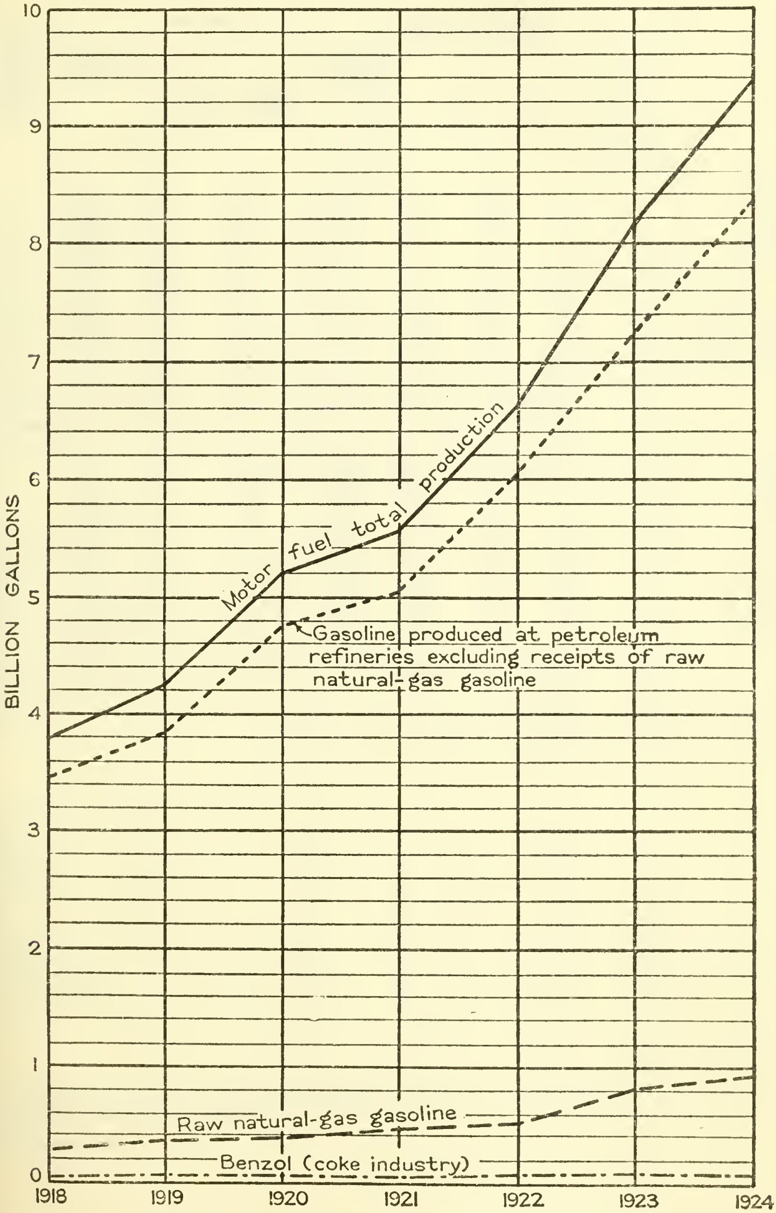

FIGURE 7.—Motor fuel produced in the United States, 1918–1924

Natural-gas gasoline produced in the United States, 1923–24, by States

State	Number of operators reporting [a]	Number of plants	Raw (unblended) gasoline produced			Estimated quantity of natural gas treated	
			Thousands of gallons	Value at plant		Millions of cubic feet	Average yield per 1,000 cubic feet (gallons)
				Thousands of dollars	Average per gallon (cents)		
1923							
Arkansas	4	7	16,183	1,916	11.8	3,975	4.1
California	57	119	173,329	16,564	9.6	211,409	.8
Illinois	30	86	7,356	851	11.6	3,207	2.3
Kansas	7	13	8,775	690	7.9	10,843	.8
Kentucky	9	11	7,601	1,067	14.0	22,925	.3
Louisiana	25	35	40,720	3,484	8.6	87,944	.5
New York	5	5	408	44	10.8	640	.6
Ohio	25	44	10,035	1,446	14.4	39,805	.3
Oklahoma	108	279	270,249	23,012	8.5	136,563	2.0
Pennsylvania	127	196	19,132	2,560	13.4	55,238	.3
Texas	48	100	177,765	14,752	8.3	113,733	1.6
West Virginia	58	162	63,381	8,890	14.0	164,906	.4
Wyoming	8	10	21,292	1,992	9.4	24,523	.9
	[a]455	1,067	816,226	77,268	9.5	875,711	.9
1924							
Arkansas	5	9	17,533	1,784	10.2	3,243	5.4
California	61	140	232,579	22,690	9.8	217,445	1.1
Illinois	29	85	9,091	795	8.7	3,451	2.6
Kansas	8	14	11,658	913	7.8	15,796	.7
Kentucky	8	10	7,274	769	10.6	24,618	.3
Louisiana	33	45	48,098	3,887	8.1	136,448	.4
New York	5	5	477	50	10.5	381	1.3
Ohio	26	47	9,443	1,148	12.2	38,865	.2
Oklahoma	108	281	301,062	23,338	7.8	172,111	1.7
Pennsylvania	127	191	19,254	2,266	11.8	63,104	.3
Texas	44	106	186,571	14,460	7.8	148,554	1.3
West Virginia	56	152	61,549	7,154	11.6	160,007	.4
Wyoming	8	11	29,272	2,979	10.2	32,253	.9
	[a]457	1,096	933,861	82,233	8.8	1,016,276	.9

[a] A producer operating in more than one State is counted only once.

Natural-gas gasoline produced in the United States, 1922–1924, by methods of manufacture

State	Number of plants			Raw (unblended) gasoline produced (thousands of gallons)			
	Compression	Absorption including combination absorption process with compression and charcoal processes	Charcoal	Compression	Absorption including combination absorption process with compression and charcoal processes	Charcoal	Drip
1922							
Arkansas		1	([a])		4,289	([a])	
California	27	50	([a])	22,558	44,272	([a])	290
Illinois	78		([a])	7,752		([a])	8
Kansas	5	3	([a])	909	1,928	([a])	19
Kentucky	5	3	([a])	561	4,644	([a])	
Louisiana	13	13	([a])	8,998	19,941	([a])	467
New York	3	1	([a])	281	225	([a])	
Ohio	29	12	([a])	1,334	7,253	([a])	13
Oklahoma	197	70	([a])	137,712	51,023	([a])	669
Pennsylvania	168	27	([a])	9,116	9,345	([a])	57
Texas	34	22	([a])	62,794	32,426	([a])	185
West Virginia	85	66	([a])	12,591	43,996	([a])	209
Wyoming	4	1	([a])	19,869	98	([a])	
	648	269	([a])	284,475	219,440	([a])	1,917
1923							
Arkansas		7			16,089		94
California	20	99		14,937	158,392		
Illinois	86			7,355			1
Kansas	5	8		4,459	4,301		15
Kentucky	3	5	3	462	6,603	536	
Louisiana	13	21	1	9,317	30,906	497	
New York	4	1		315	93		
Ohio	29	15		1,251	8,777		7
Oklahoma	178	101		138,455	130,991		803
Pennsylvania	168	27	1	7,943	10,912	204	73
Texas	42	58		80,033	97,703		29
West Virginia	68	91	3	8,627	53,278	1,186	290
Wyoming	4	6		17,718	3,474		100
	620	439	8	290,872	521,519	2,423	1,412
1924							
Arkansas		9			17,533		
California	16	124		13,520	219,059		
Illinois	85			9,089			2
Kansas	5	9		614	11,042		2
Kentucky	3	4	3	1,128	5,182	964	
Louisiana	14	30	1	7,105	[b] 40,952	([b])	41
New York	4	1		333	144		
Ohio	30	16	1	1,268	[b] 8,170	([b])	5
Oklahoma	176	105		117,424	183,128		510
Pennsylvania	164	23	4	7,315	10,716	1,076	147
Texas	43	63		66,995	119,478		98
West Virginia	93	56	3	12,968	46,856	1,383	342
Wyoming	[c] 1 5	5		20,135	9,059		78
	639	445	12	257,894	670,678	4,064	1,225

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[a] Charcoal included under combination processes. Separate data not collected.

[b] Charcoal included under combination processes in order to avoid disclosing the production of individual operators.

[c] Refrigeration.

Natural-gas gasoline turned into crude-petroleum pipe lines in the United States, 1923–24, by States, in gallons

State	1923	1924	State	1923	1924
California	50,398,000	87,135,000	Texas	3,529,000	347,000
Illinois	26,000	----------	West Virginia	25,000	----------
Louisiana	3,049,000	373,000	Wyoming	1,838,000	----------
Oklahoma	15,418,000	1,640,000			
Pennsylvania	252,000	----------		74,535,000	89,495,000

Natural-gas gasoline produced in the United States, 1911–1924, by States, in thousands of gallons

Year	Arkansas	California	Colorado	Illinois	Kansas	Kentucky	Louisiana	New York	Ohio
1911	--------	(a)	(a)	(a)	--------	(a)	--------	(a)	1,679
1912	--------	1,041	(a)	(a)	--------	(a)	--------	(a)	1,719
1913	--------	3,461	(a)	(a)	(a)	(a)	--------	(a)	2,073
1914	--------	7,581	(a)	1,164	(a)	(a)	--------	(a)	2,440
1915	--------	12,835	(a)	1,035	(a)	(a)	(a)	(a)	2,199
1916	--------	17,159	(a)	2,260	215	725	2,113	(a)	2,639
1917	--------	28,818	(a)	4,934	1,175	3,818	4,980	(a)	5,440
1918	--------	32,269	2	4,575	2,390	3,331	7,021	218	6,745
1919	--------	40,386	--------	6,060	3,284	5,136	10,063	458	8,801
1920	--------	48,208	--------	6,055	4,331	4,497	10,610	411	10,016
1921	--------	58,220	--------	7,536	3,587	4,242	15,341	366	9,100
1922	4,289	67,120	--------	7,760	2,856	5,205	29,406	506	8,600
1923	16,183	173,329	--------	7,356	8,775	7,601	40,720	408	10,035
1924	17,533	232,579	--------	9,091	11,658	7,274	48,098	477	9,443
	38,005	723,006	(a)	57,826	38,271	41,829	168,352	2,844	80,929
Percentage of total	0.9	17.2	--------	1.4	0.9	1.0	4.0	0.1	1.9

Year	Oklahoma	Pennsylvania	Texas	West Virginia	Wyoming	Miscellaneous	Total	Value at plant	
								Thousands of dollars	Average per gallon (cents)
1911	388	1,467	--------	3,660	--------	232	7,426	532	7.2
1912	1,575	2,041	--------	5,318	--------	387	12,081	1,157	9.6
1913	6,463	3,680	--------	7,662	--------	722	24,061	2,458	10.2
1914	17,278	4,612	--------	9,278	--------	300	42,653	3,106	7.3
1915	31,666	5,899	(a)	10,854	--------	877	65,365	5,151	7.9
1916	48,360	9,715	1,293	18,765	--------	249	103,493	14,331	13.8
1917	115,123	13,826	6,920	32,669	--------	181	217,884	40,189	18.4
1918	163,701	15,775	7,326	37,604	1,579	--------	282,536	50,364	17.8
1919	189,995	20,284	9,337	52,150	5,581	--------	351,535	64,197	18.3
1920	178,857	21,151	32,956	58,941	8,711	--------	384,744	71,788	18.7
1921	185,341	19,856	77,141	54,646	14,558	--------	449,934	61,815	13.7
1922	189,404	18,518	95,405	56,796	19,967	--------	505,832	72,711	14.4
1923	270,249	19,132	177,765	63,381	21,292	--------	816,226	77,268	9.5
1924	301,062	19,254	186,571	61,549	29,272	--------	933,861	82,233	8.8
	1,699,462	175,210	594,714	473,273	100,960	[b]2,950	4,197,631	547,300	13.0
Percentage of total	40.5	4.2	14.1	11.3	2.4	0.1	100.0	--------	--------

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[a] Included under "Miscellaneous."
[b] Includes also Colorado for 1918.

Natural gas produced and consumed in the United States and portion treated for recovery of natural-gas gasoline, 1911–1924

	Produced and delivered to consumers (millions of cubic feet)	Consumed (millions of cubic feet)	Treated for recovery of gasoline (millions of cubic feet)	Ratio (percentage) of natural gas treated for gasoline	
				To quantity produced and delivered to consumers	To quantity consumed
1924					
Arkansas	36,616	44,595	3,243	9	7
California [a]	189,692	189,692	217,445	115	115
Illinois	4,072	4,072	3,451	85	85
Kansas	25,580	40,528	15,796	62	39
Kentucky [b]	12,875	21,514	24,618	191	114
Louisiana	160,945	163,469	136,448	85	83
New York	[c] 6,196	16,506	381	6	2
Ohio	47,396	111,353	38,865	82	35
Oklahoma	214,452	183,451	172,111	80	94
Pennsylvania	105,863	123,932	63,104	60	51
Texas [a] [b]	[d] 107,247	107,447	148,554	139	138
West Virginia [e]	182,285	79,240	160,007	88	202
Wyoming	46,036	44,879	32,253	70	72
Others	2,266	10,804	------------	------------	------------
	[f] 1,141,521	1,141,482	1,016,276	89	89
1911	512,993		2,476	0.5	
1912	562,203		4,688	1	
1913	581,898		9,889	2	
1914	591,867		16,895	3	
1915	628,579		24,064	4	
1916	753,170		208,705	28	
1917	795,110		429,288	54	
1918	721,001		449,109	62	
1919	745,916		480,404	64	
1920	798,210		496,431	62	
1921	662,052		465,097	70	
1922	762,546		545,139	71	
1923	[g] [h] 1,006,976	[h] 1,006,967	875,711	87	87

[a] Large quantities of gas both before and after the recovery of gasoline were blown in the air or unaccounted for.

[b] Quantities of natural gas were piped from other States, treated for gasoline recovery, and residue gas returned to State in which produced.

[c] Includes 12,000,000 cubic feet piped to Canada.

[d] Includes 27,000,000 cubic feet piped to Mexico.

[e] Natural gas was treated for gasoline recovery and consumed in other States.

[f] Includes 39,000,000 cubic feet piped to Canada and Mexico.

[g] Includes 9,000,000 cubic feet piped to Mexico.

[h] Revised figures.

Approximate production of motor fuel in the United States, 1918–1924, in thousands of gallons

	1918	1919	1920	1921	1922	1923	1924
Gasoline, including naphthas and other products lighter than kerosene, produced at refineries	3,570,313	3,957,857	4,882,547	5,153,549	6,202,235	7,555,945	8,959,680
Raw natural-gas gasoline blended at refineries	102,956	124,185	132,423	105,696	153,795	230,454	532,195
Raw natural-gas gasoline turned into crude-petroleum pipe lines (to be recovered by distillation)	([a])	([a])	([a])	([a])	([a])	74,535	89,495
Raw natural-gas gasoline produced	282,536	351,535	384,744	449,934	505,832	816,226	933,861
Benzol produced by the coke industry	44,805	61,068	83,371	54,459	70,111	97,335	91,904
Motor fuel produced	3,794,698	4,246,275	5,218,239	5,552,246	6,624,383	8,164,517	9,363,755
Percentage of raw natural-gas gasoline produced to total motor fuel produced	7.4	8.3	7.4	8.1	7.6	10.0	10.0

[a] Data not available.

TALC AND SOAPSTONE

By L. M. PRINDLE and B. H. STODDARD [1]

PRODUCTION

Both the total quantity and value of talc and soapstone sold by the producers during 1924 increased in comparison with sales for preceding years except 1920. (See fig. 8.) The quantity sold in 1924 was the largest reported since the record year 1920, and the value was the highest ever recorded. All branches of the industry, however, did not share in the prosperity. In Vermont, whose production is used largely in the roofing trade, depression existed for a large part of the year, and the demand was, in general, unsatisfactory for all grades, especially roofing and paper. In the talc region of New York, however, the trade showed improvement over 1923, and was stimulated by the finding of new uses for the fibrous talc of this State, which is particularly suitable for filler in the manufacture of paper. In the South Georgia and Maryland showed greatly increased sales of talc, and in North Carolina and Virginia there was renewed activity in soapstone mining. Shipments in California showed little change from 1923.

Talc and soapstone sold by the producers in the United States, 1920–1924

Year	Crude		Sawed and manufactured				Ground		Total	
			Talc		Soapstone					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1920	11,008	$43,820	1,415	$139,335	19,707	$709,400	178,505	$2,142,894	210,635	$3,035,449
1921	2,150	12,911	([a])	([a])	[a]17,423	[a] 627,826	102,413	1,115,205	121,986	1,755,942
1922	4,981	22,582	654	86,333	22,700	712,144	170,349	2,038,838	198,684	2,859,897
1923	5,706	50,125	682	114,772	22,857	932,098	167,447	1,915,258	196,692	3,012,253
1924	5,710	22,247	846	109,405	25,630	1,288,885	171,635	2,095,019	203,821	3,515,556

[a] Sawed and manufactured talc included under "Soapstone."

The sales of the several grades of talc and soapstone are shown in the preceding table. Practically all talc sold in the crude state by producers is eventually ground, but as figures are collected only from producers the value of this material after grinding is unknown.

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[1] Figures for imports and exports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce. Figures for world's production compiled by L. M. Jones, of the Bureau of Mines.

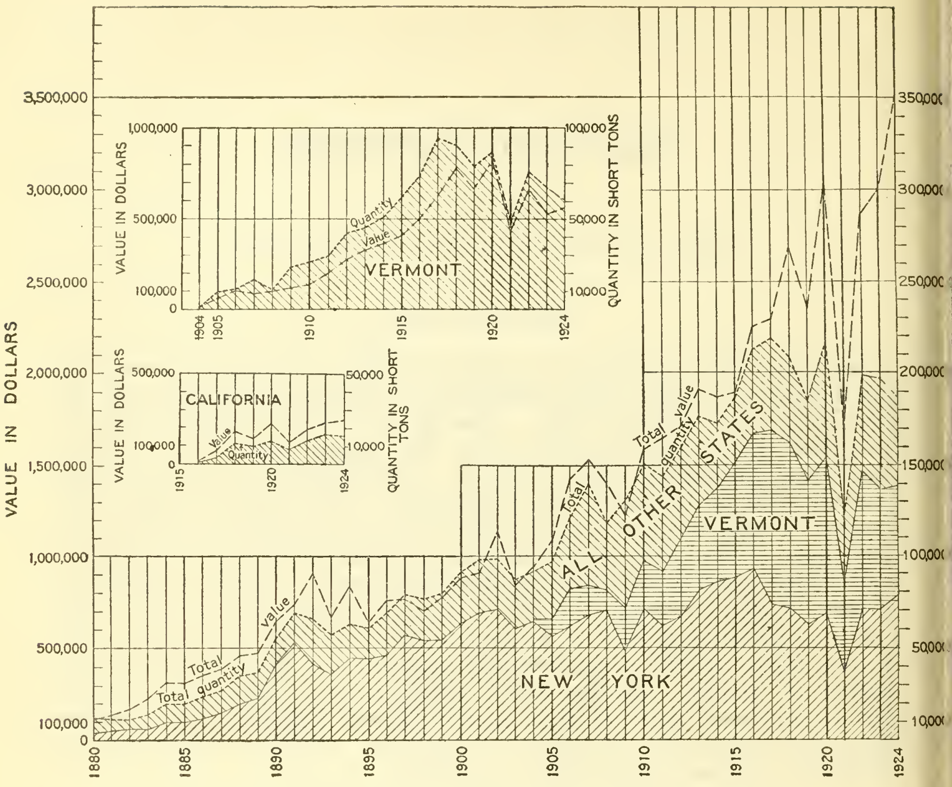

FIGURE 8. Talc and soapstone produced in the United States, 1880–1924

Talc and soapstone sold by the producers in the United States, 1922–1924, by States

State	1922		1923		1924				
	Short tons	Value	Short tons	Value	Short tons	Value	Per cent of total quantity	Percentage of increase or decrease	
								Quantity	Value
New York	71,470	$1,116,914	71,304	$1,079,322	78,340	$1,162,488	38	+10	+8
Vermont	75,485	654,715	67,100	533,510	61,653	573,747	30	−8	+8
Virginia	25,351	736,132	26,095	960,628	28,219	1,306,388	14	+8	+36
California	12,638	187,011	16,144	224,838	16,335	247,799	8	+1	+10
Pennsylvania and New Jersey	8,373	87,367	8,182	82,597	8,281	83,296	4	+1	+1
North Carolina	2,194	23,049	6,491	89,290	6,093	81,523	3	−6	−9
Maryland	1,667	14,667	580	25,500	3,015	29,767	2	+420	+17
Georgia	1,506	40,042	796	16,568	1,885	30,548	1	+137	+84
	198,684	2,859,897	196,692	3,012,253	203,821	3,515,556	100	+4	+17

REVIEW BY STATES

California.—Practically all of the domestic high-grade talc suitable for making talcum powder is produced in California. The requirements for this purpose are pure white or flesh color, good slip, and freedom from grit or harmful impurities such as iron and lime. The producing companies numbered 6 in 1924, as compared with 7 in 1923. Walter S. McLean shipped crude talc and soapstone from the McLean talc claim in Butte County and the Swift soapstone quarry in Eldorado County. The Master Minerals Co., formerly the Master Products Co., worked the Tropico talc mine at Acme. A new company, the Western Talc & Magnesite Co., shipped talc from Inyo County, near Tecopa. The average value of crude shipped in this State in 1924 was $5.60 a short ton, and in 1923 $5.77; the average value of ground talc was $17.32 a short ton in 1924 and $17.43 in 1923.

Georgia.—The Georgia Talc Co. was the only producer of talc in Georgia in 1924. The largest quantity was sold in the ground form at an average value of about $6 a short ton, but some was used in the manufacture of crayons that were sold for more than $200 a ton.

Maryland.—Two producers of talc in Maryland resumed operations in 1924. The Maryland Mineral Co. (Inc.) shipped crude talc from near Conowingo, and Herbert I. Oursler shipped talc schist from Henryton. The Harford Talc Co. continued to mine a refractory talc at its property near Dublin, Harford County.

New Jersey and Pennsylvania.—Ground talc mined in New Jersey and Pennsylvania was shipped by the Rock Products Co., J. O. Wagener & Co., and C. K. Williams & Co.; the average value a short ton was about $10.

New York.—Two firms, the International Pulp Co. and the W. H. Loomis Talc Corporation, shipped fibrous talc from St. Lawrence County. The W. H. Loomis Talc Corporation reported that it had experimented with favorable results with talc as an ingredient in concrete to make it waterproof, and had also used special grades of talc as a high-grade paper filler with like satisfaction (see p. 345). A third producer, the Carbola Chemical Co. (Inc.), continued actively its operations in Lewis County, near Natural Bridge.

The talc near Natural Bridge, in contrast to that of the other producing localities in New York, is granular. It is ground and used in making mineral paint or whitewash that can be applied as a dry powder or mixed with water in the usual way.

Ground talc was the only grade shipped in the State, and the average value a short ton was $14.84.

North Carolina.—The Georgia Talc Co., which mines pyrophyllite, continued the manufacture of crayons at its property near Marshall, Madison County. Another producer of pyrophyllite was the Standard Mineral Co. (Inc.), whose property is near Hemp, Moore County. Shipments of soapstone were made by the National Soapstone Co. (Inc.), a new operator, from its property near West Jefferson, Ashe County.

Vermont.—The quantity of talc sold by producers in Vermont in 1924 showed no gain from 1923, but the total value of the product increased 8 per cent. The average value of ground talc in this State for 1924 was $8.73 a short ton. No new operators were reported.

Virginia.—New operations in Virginia were the mining of soapstone by the Charlottesville Soapstone Corporation, whose property is 3 miles from Esmont, Albermarle County, and by the Phoenix Stone Co. (Inc.), 4 miles south of Arrington, Nelson County. The greater part of the Virginia output is soapstone, manufactured by the two concerns mentioned above and by the Virginia Alberene Corporation. The Blue Ridge Talc Co. (Inc.) and the Bull Run Talc & Soapstone Co. (Inc.) shipped ground talc.

LIST OF PRODUCERS

Producers of talc and soapstone in the United States in 1924

Name and address	Location of mine
CALIFORNIA	
W. S. McLean, 639 Brannan Street, San Francisco	Butte County and near Latrobe, Eldorado County.
Master Minerals Co., 1901–1929 East Slausen Avenue, Los Angeles.	Acme, San Bernardino County.
Pacific Coast Talc Co., 2149 Bay Street, Los Angeles	7 miles north of Silver Lake station, San Bernardino County.
Russi Soapstone Co., Folsom	1¼ miles from Shingle station, Eldorado County.
Sierra Talc Co., 401 Equitable Bank Building, Los Angeles.	18 miles from Keeler, Inyo County.
Western Talc & Magnesite Co., Los Angeles	Tecopa, Inyo County.
GEORGIA	
Georgia Talc Co., Asheville, N. C.	Foot of Cohutta Mountain, 3¼ miles southeast of Chatsworth, Murray County.
MARYLAND	
Harford Talc Co., 1801 Chelsea Road, Baltimore	Near Dublin, Harford County.
Maryland Mineral Co. (Inc.), Conowingo	Conowingo, Cecil County.
Herbert I. Oursler, Marriottsville	¼ mile west of Henryton, Carroll County.
NEW JERSEY	
Rock Products Co., 403 Trust Building, Easton, Pa.	Above Marble Hill, on Delaware River, near Phillipsburg, Warren County.
NEW YORK	
Carbola Chemical Co. (Inc.), Natural Bridge	1¼ miles from Natural Bridge, Lewis County.
International Pulp Co., 41 Park Row, New York City	Talcville, St. Lawrence County.
W. H. Loomis Talc Corporation, 173 East Main Street, Gouverneur.	Fowler, St. Lawrence County.
NORTH CAROLINA	
Georgia Talc Co., Asheville	On Big Laurel Creek, 9 miles north of Marshall, Madison County.
National Soapstone Co. (Inc.), Baldwin	Near West Jefferson, Ashe County.
Standard Mineral Co. (Inc.), Hemp	2½ miles from Hemp, Moore County.
PENNSYLVANIA	
J. O. Wagener & Co., 520 McCartney Street, Easton	On Bushkill Creek, 3 miles above Easton, Northampton County.
C. K. Williams & Co., 640 North Thirteenth Street, Easton.	Near Easton, Northampton County.
VERMONT	
American Mineral Co., 192 Bank Street, Burlington	Johnson, Lamoille County.
American Soapstone Finish Co., Chester	2½ miles from Chester, Windsor County.
Eastern Magnesia Talc Co. (Inc.), Burlington	East Granville, Addison County; Rochester, Windsor County; and Waterbury, Washington County.
Vermont Talc Co., Chester	Windham, Windham County.
VIRGINIA	
Blue Ridge Talc Co. (Inc.), Henry	¾ mile east of Henry station, Franklin County.
Bull Run Talc & Soapstone Co. (Inc.), Clifton Station	3 miles north of Clifton, Fairfax County.
Charlottesville Soapstone Corporation, Charlottesville	3 miles from Esmont, Albermarle County.
Phoenix Stone Co. (Inc.), 150 Broadway, New York, N. Y.	4 miles south of Arrington, Nelson County.
Virginia Alberene Corporation, 153 West Twenty-third Street, New York, N. Y.	Schuyler, Nelson County.

FORM IN WHICH TALC IS SOLD BY PRODUCERS

The quality of the talc and the demand for the different uses determine the manner of preparation for the market. In 1924, 3 per cent was sold rough (crude) as it came from the mine, less than 1 per cent was sold as cut pencils and crayons and as blanks used for refractory purposes, and 96 per cent was ground to talc powder.

Talc sold by the producers in the United States in 1924, by classes

Form in which sold	Short tons	Value	
		Total	Average
Rough (crude)	5, 710	$22, 247	$3. 90
Sawed and manufactured [a]	846	109, 405	129. 32
Ground [b]	171, 635	2, 095, 019	12. 21
	178, 191	2, 226, 671	----------

[a] For slate pencils and metal workers' crayons and for blanks used in making acetylene burners and other objects.

[b] For filler in paper, paint, and rubber goods, and for toilet powder, foundry facings, textiles, lubricators, electric insulation, etc.

Soapstone in rough quarry blocks or in crude state is worth about $5 a ton. Reports of producers showed, however, that no soapstone was sold in that form in 1924. When sawed into slabs and manufactured into laundry tubs, laboratory table tops, and other products, its value increases greatly, and material of this class averaged about $50 a short ton in 1924.

IMPORTS AND EXPORTS

Talc imported for consumption in the United States, 1920–1924

Year	Crude and unground steatite and French chalk			Manufactures (except toilet preparations) wholly or partly finished			Total	
	Short tons	Value		Short tons	Value		Short tons	Value
		Total	Average		Total	Average		
1920	941	$7, 206	$7. 57	21, 739	$443, 514	$20. 40	22, 680	$450, 720
1921	153	2, 279	14. 90	11, 468	239, 469	20. 88	11, 621	241, 748
1922	248	9, 850	40. 00	18, 196	367, 528	20. 20	18, 444	377, 378
1923	560	20, 653	36. 88	19, 405	402, 238	20. 73	19, 965	422, 891
1924	313	4, 847	15. 49	17, 496	337, 508	19. 29	17, 809	342, 355

Talc, ground or unground, imported into the United States, 1923–24, by countries

[General imports]

Country	1923		1924	
	Short tons	Value	Short tons	Value
Austria	611	$19,914	138	$4,411
Belgium	822	5,428	1,106	6,680
Canada	7,111	99,902	7,432	88,608
China	2	2,376	29	13,136
Chosen	([a])	4	-----	-----
Czechoslovakia	-----	-----	2	114
England	123	2,722	121	1,443
France	3,384	51,035	3,091	49,861
Germany	36	1,167	2	1,653
Greece	3	57	-----	-----
Hongkong	([b])	59	([c])	184
India (British)	55	3,446	84	3,601
Italy	7,457	227,858	6,165	185,730
Japan	2	1,113	1	301
Norway	347	9,073	-----	-----
Palestine and Syria	-----	-----	([d])	4
Scotland	1	45	-----	-----
Spain	-----	-----	28	903
Switzerland	34	1,078	-----	-----
	19,988	425,277	18,199	356,629

[a] 3 pounds. [b] 241 pounds. [c] 344 pounds. [d] 5 pounds.

Exports of talc in bulk are not recorded. The exports of "talcum and other toilet powders" in 1922 amounted to 1,821 short tons, valued at $1,397,542; in 1923, 1,907 tons, valued at $1,671,588; and in 1924, 1,614 tons, valued at $1,688,211.

WORLD'S PRODUCTION

World's production of talc and soapstone, 1920–1924, by countries, in metric tons

Country	1920	1921	1922	1923	1924
Argentina	20	([a])	([a])	([a])	([a])
Australia:					
New South Wales	214	61	203	207	543
South Australia	201	262	272	425	330
Austria (exports)	6,894	8,031	13,511	7,489	9,683
Canada	19,659	9,184	11,970	9,404	10,280
France	52,420	34,742	48,170	([a])	([a])
Germany (Bavaria)	20,943	6,619	4,513	1,907	([a])
India (British)	3,740	2,103	921	7,136	2,898
Italy	21,475	21,031	26,485	31,150	32,168
Japan	([a])	([a])	49,003	35,828	([a])
Norway	-----	2,810	7,821	8,907	11,785
Spain	2,146	1,115	3,078	1,983	1,457
Sweden	([a])	[b]1,797	[b]2,063	[b]2,430	[b]2,873
Union of South Africa (Transvaal)	619	375	309	322	513
United Kingdom	367	-----	51	189	-----
United States	191,084	110,663	180,242	178,435	184,902
Uruguay (exports)	1,801	1,755	609	([a])	([a])

[a] Data not available.
[b] Exclusive of a small quantity for which value only is given.

USES

Powdered talc and soapstone are used extensively in the paper, paint, roofing, rubber, foundry, and textile industries, and for toilet preparations. A rather unique use of powdered talc is by the farmer, who is said to dust the grains of corn before planting, in order to prevent the crows from eating them. Massive talc of the variety known as "lava" grade, free from iron and grit, with no cracks or cleavage planes, is cut into gas tips, blanks for electric insulation, and spark plugs. Only small amounts of this variety are produced in the United States. Talc is also made into crayons and pencils, and is used in glass making, and as a polishing agent. Massive soapstone is manufactured into laundry tubs, trays, sinks, laboratory table tops, furnace blocks, fuse guards, tiles, treads, aquariums, switchboards, panel boards, bases, insulators, wainscoting, fireless cooker stones, hearth linings, furnace linings, and griddles.

There has been a demand among producers for more accurate information regarding the physical characteristics of talc, especially the melting point. The talc as mined contains a larger or smaller proportion of such minerals as chlorite, calcium or magnesium carbonate, iron pyrites, quartz, or other minerals. A small admixture of other minerals lowers the melting point. Material from different mines or even different parts of the same mine may differ considerably in melting point.

In investigations of talc and soapstone from different localities in Switzerland, the melting points found ranged from 1,330 to 1,480° centigrade. The material began to turn brown at about 850°, became harder, and reached maximum hardness at 1,030 to 1,410°. Instead of using solid blocks of the natural talc or soapstone the investigators granulated the talc, mixed it with a binder, and pressed it into various forms. In some cases such material was heated to about 1,200° centigrade, when it became a reddish brown very hard substance that could be used as a substitute for emery. Further information on the technology of talc, including data on melting points, will be found in these publications: Der schweizerische Bergbau während des Weltkrieges, by H. Fehlman, pages 179 to 212, 1919, and "Der Talkberbau von Disentis in Graubunden" by Arnold Heim: Zeitschrift für praktische Geologie, vol. 26, 1918, pages 2 to 11.

Some talcs expand unequally on heating and it is probable that grinding and pressing with a suitable binder would be of advantage for certain purposes. The Bureau of Mines has been experimenting on the possibility of using talc as the main ingredient in ceramic bodies of high dielectric strength and resistance to heat shock.

In New York and Vermont the supplies of talc are relatively abundant and some of the producers are conducting investigations for improving the quality of ground talc and for increasing its field of usefulness.

The advantage of such research is shown by the results already obtained by the Loomis Talc Corporation in New York in producing a better quality of material for a paper filler and in recognizing the advantage of using talc in concrete. This company has made extensive and successful experiments on the use of talc in concrete as a waterproofing agent and it has also used talc in making mortar. The use of talc in concrete opens a wide field for experiment and is perhaps the most outstanding feature of the year in the talc industry.

The demands of the producers regarding talc are well stated in the following quotation from an article by J. B. Aikman, of the Vermont Talc Co., entitled "Talc: Its origin, properties, and uses," published in the Rose Technic, Terre Haute, Ind., May, 1925:

> While the production and consumption of ground talc of commercial grades has developed to considerable proportions in the comparatively short period of two or three decades, with good prospect of further growth in demand for it,

the industry suffers from some disadvantages probably the result in part of this very fact.

Of course, the chemical and physical properties of any raw material must determine its adaptability for various uses. In the case of talc, its chemical nature can not very well be modified, and, moreover, this is not necessary as it undergoes no chemical change in most uses to which it is applied.

Its physical properties, however, are of the utmost importance to consumers and these are susceptible of modification and control within reasonable limits through the methods of its preparation for the market.

Unfortunately, however, little knowledge exists as to the exact chemical and physical requirements of the various manufacturing processes in which it has thus far been employed. Hence, its marketing has depended altogether too much on individual opinion, prejudice and all around rule-of-thumb considerations.

As a result it is often misjudged and made to suffer from unjust competition with other materials with which it is not fairly comparable. On the other hand, this ignorance sometimes leads to attempts to use talc for purposes for which it is unsuited with the ensuing natural damage to its prestige as a raw material.

Standardized methods, acceptable alike to producers and consumers, have yet to be devised and adopted for testing those physical properties which are the foundation of its successful and advantageous sale and use. The most important of these properties are hardness, color, size of grain, shape of grain, "slip," specific gravity, character of grit, absorptive power, and behavior under heat.

It is not to be understood that nothing has been done along these lines, but what has been accomplished is wholly inadequate, so it is the hope of talc producers, at least, that the problem may soon make a stronger appeal to those interested in scientific research in the field of nonmetallic minerals.

CEMENT

By E. F. Burchard and B. W. Bagley

ONE HUNDRED YEARS OF PORTLAND CEMENT

In 1924 Portland cement completed a century of service. It is fitting, therefore, at this time to outline some of the outstanding features of the growth of the industry and to discuss certain historical tables and graphs of production and prices that lack of space has kept out of recent volumes of Mineral Resources.

Mineral cementing materials [1] were known to the Egyptians 5,000 years ago, as is evidenced by the remains of structures in which plaster made of gypsum was used in masonry and as stucco. Later, the Romans used lime mortars and still later they made a cement similar to the present puzzolan type by pulverizing volcanic ash and mixing it with quicklime. The most important ingredient in the cementing materials used by the Romans was lime, and in burning limestone to quicklime it is probable that in places they used argillaceous material and thus made natural cement. This cement, however, was not perfected until late in the eighteenth century; puzzolan and natural cements antedated Portland cement by many centuries.

The development of the chief types of hydraulic cements came about through industrial progress and necessity rather than pure accident, although accidental discoveries have played an important part in leading to the desired results. It was in 1756, in connection with the building of the Eddystone Lighthouse in England, that a hydraulic mortar, one which would set under water, was sought. In the United States the construction of canals further emphasized this requirement. Since the natural cements did not satisfy all the requirements of use, especially as to uniformity of strength and time of set, efforts were made in the early part of the nineteenth century, particularly by an English bricklayer, Joseph Aspdin, to produce a more satisfactory cement. Manufacturers of hydraulic lime and natural cement, theretofore, had endeavored to avoid burning the rock to vitrification and had rejected the lumps so hardened. Aspdin tried for some years to make a hydraulic cement from hard limestone and clay, and finally, through burning his raw material at temperatures higher than customary, he succeeded in making a cement that seems to be the most direct forerunner of Portland cement. In fact, Aspdin, in applying for a patent, called his product "Portland" cement, because its color resembled that of building stone from the Isle of Portland. Of course there have been many modifications in Portland cement since the days of Aspdin, a wider range of raw materials has become available for use by manufacturers and essential standards have been established, with the result that to-day, especially in the United States, Portland cement represents a highly standardized and uniform product. Nevertheless, Aspdin has been formally and officially recognized as the inventor.

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[1] For more extended discussions of the history of cementing materials, their definitions, properties, and technology, the reader is referred to the following publications and the volumes of Mineral Resources from 1910 to 1920: Eckel, E. C., Cements, Limes, and Plasters, 2d ed.: New York, 1922, 655 pp. Lesley, Robert W., History of the Portland Cement Industry in the United States: 1924. Eckel, E. C., Burchard, E. F., and others, Portland Cement Materials and Industry in the United States: U. S. Geol. Survey Bull. 522, 1913, 401 pp.

In the summer of 1924 representatives of the American Portland Cement Association attended a celebration in England where a bronze tablet in memory of Joseph Aspdin, the gift of the association, was unveiled at Leeds. Later, on November 19, the official American celebration of the 100th anniversary of Aspdin's invention was held at the annual meeting of the Portland Cement Association in Chicago. The latest tribute to the work of Aspdin was the presentation on March 27, 1925, by the Portland Cement Association to the Smithsonian Institution at Washington, D. C., of a photographic copy of the original Portland cement patent granted by King George IV to Joseph Aspdin, October 21, 1824. This copy, a replica of the original patent which is still in the possession of the Aspdin family, shows also a reproduction of the bronze memorial tablet mentioned above. It was brought to the United States by the former Lord Mayor of Leeds and has been placed in the division of mineral technology of the United States National Museum, in which is displayed a model of a modern Portland cement plant.

For nearly 50 years after Aspdin's discovery the United States depended for its cement supplies on domestic natural cement and upon imports from Europe of both Portland and natural cements. For extensive projects and for construction during winter Portland cement gradually gained in favor until enough interest developed to cause its manufacture in the United States. In 1872 David O. Saylor, already a manufacturer of natural cement in the Lehigh district, built at Coplay, Pa., a plant consisting of vertical kilns and essayed to make a "new and improved" cement from argillo-magnesian and argillo-calcareous limestone. The mixture of stone was calcined and the product was crushed, ground, and seasoned. In his application for a patent Saylor claimed that the stone to be used contained the same ingredients as that used for making Portland cement, and that the products could not be distinguished from each other except by treatment. Soon afterward other pioneers began the manufacture of Portland cement from cement rock in the Lehigh district and from limestone and shale in western Pennsylvania, as well as from marl and clay in Indiana. The use of domestic natural cement and imported Portland cement was, however, firmly intrenched, and it was not until about 1895 that domestic Portland cement began to show a rapid gain in output. In fact, it was not until 1900 that the output of domestic natural cement, decreasing from its peak in 1899, was equaled by the production of Portland cement. (See fig. 11.)

To chronicle the mechanical and chemical developments that have contributed to the development of the cement industry since it began its rapid growth 30 years ago would require more space than is available here, but a few conspicuous steps may be mentioned. The first kilns, as has been mentioned, were vertical, like limekilns, and operations were intermittent. An attempt was made to improve operation by making it continuous, but as this change could at most only double the output, interest was soon directed toward the rotary kiln which was in use in England. This type of kiln was first introduced into the United States in 1889. Its use necessitated radical change in the form of fuel, for the vertical kiln had used coke or coal interbedded with the stone, but the rotary required a gaseous fuel and this could be supplied only by blowing oil, gas, or pulverized coal into the kiln. This change of kilns and fuel, which became general within the next few years, marks the beginning of the rapid increase in output of Portland cement through increased capacity of plants and lower cost of production.

Cited here without regard to their order of adoption—many of them may be said to have been developed more or less contemporaneously—are the introduction of steam shovels in quarrying, enlargement of crushing, grinding, conveying, and storage facilities, improvements in power plants, introduction of electrical drives, use of mechanical packing and weighing devices, improvement and extension of wet process, finer grinding of raw materials and finished cement, dust collection, increased length and diameter of kilns, enlargement of lower end of kilns, utilization in power plant boilers of waste heat from rotary kilns, and the use of concrete for plant construction. With all this development has come more accurate chemical control of the product and a gradual improvement of its quality.

A recent trend in the industry has been toward still further improvements in Portland cement and the development of special qualities, such as the early hardening of the high-alumina cements which makes them desirable for road or bridge repair work or for work in cold weather or where the forms can not long be used. Quick-setting cement has been developed for use in oil wells and cement with good plasticity and water-retarding properties for use in stucco finish. To some extent the efforts to produce improved Portland cement have led experimenters outside the limits of that type of cement officially defined as "the product obtained by finely pulverizing clinker produced by calcining to incipient fusion an intimate and properly proportioned mixture of argillaceous and calcareous materials with no addition subsequent to calcination except water and calcined or uncalcined gypsum." Certain of the departures are fused cements high in iron and alumina or in titanium.[2]

F. W. Kelly,[3] president of the Portland Cement Association in 1924, attributes the development of the Portland cement industry in the United States largely to five factors, as follows: (1) Systematic application of chemistry; (2) development of efficient grinding machinery; (3) development of rotary kiln; (4) development of standard specifications; (5) systematic study of the best uses for concrete and best methods of making it.

The chief improvement of the Portland cement industry in the United States thus may be said to have been introduced during the last 25 to 30 years, and this period is coincident with the enormous increase in output as shown in the statistical tables and graphs, pages 352 to 359. This period of development also has coincided with the existence of the Portland Cement Association, one of the largest engineering, educational, and scientific research organizations in the world, which aims to increase the knowledge, utility, and use of

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[2] See bibliography of alumina and other special cements, p. 375.

[3] Kelly, F. W., "Progress in cement manufacture in 20 years": Concrete, March, 1924, pp. 85-87.

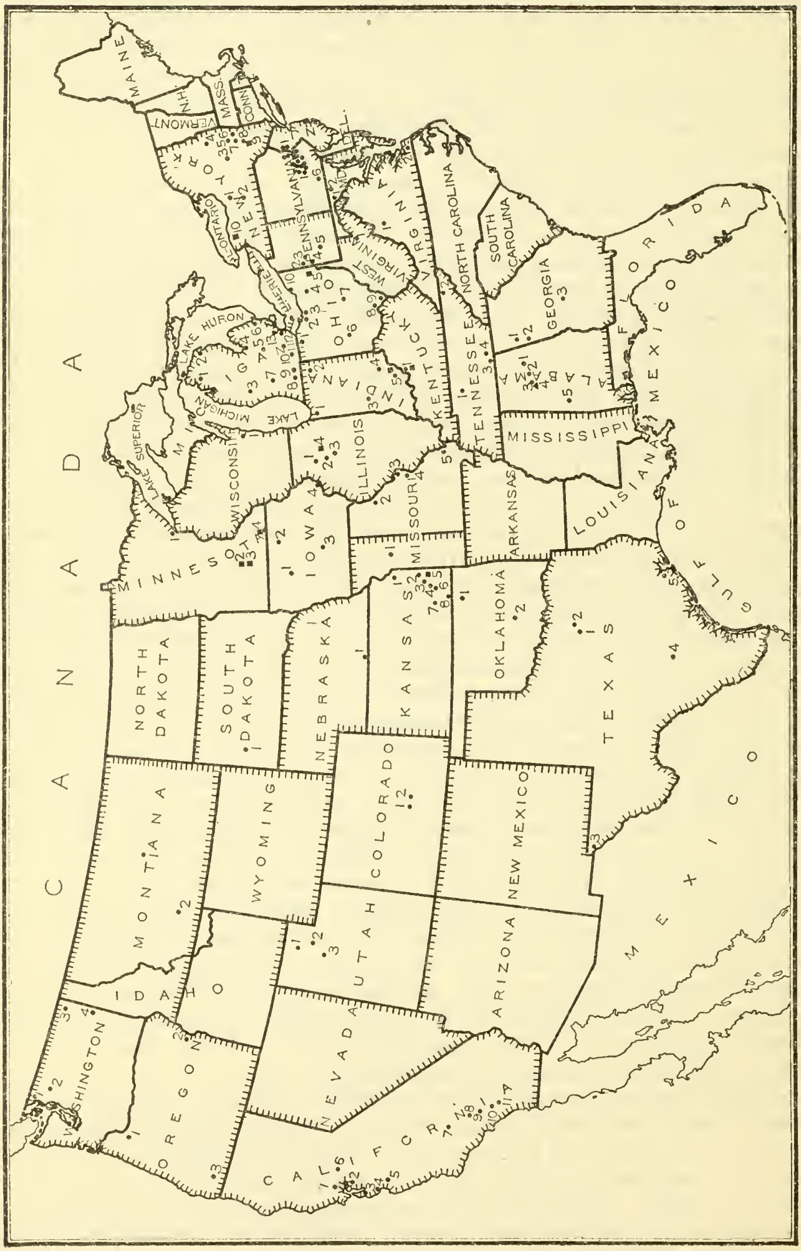

FIGURE 9.—Distribution of cement plants in United States. (See opposite page for names.)

Cement plants shown in Figure 9

[Portland cement unless otherwise specified. N=natural cement. PZ=puzzolan cement]

NAME AND LOCATION

ALABAMA

1. National, Ragland.
2. Atlas, Leeds.
3. Lehigh
   Alabama
   North Birmingham
4. Southern (PZ), North Birmingham.
5. Warrior, Spocari.

CALIFORNIA

1. Pacific, Cement.
2. Cowell, Cowell.
3. Pacific, Redwood City.
4. Santa Cruz, Davenport.
5. Old Mission, San Juan Bautista.
6. *Calaveras, San Andreas.
7. Monolith, Monolith.
8. Southwestern, Victorville.
9. Golden State, Orogrande.
10. California, Colton.
11. Riverside, Riverside.

COLORADO

1. Colorado, Portland.
2. United States, Concrete.

GEORGIA

1. Georgia Cement & Stone, Portland.
2. Southern States, Rockmart.
3. Clinchfield, Coreen.

ILLINOIS

1. Sandusky, Dixon.
2. Alpha
   Marquette
   La Salle.
3. Lehigh, Oglesby.
4. Utica (N), Utica.

INDIANA

1. Universal, Buffington.
2. Wabash, Stroh.
3. Indiana, Greencastle.
4. Lehigh, Mitchell.
5. Louisville (also N), Speed.

IOWA

1. Gilmore, Gilmore City.
2. Lehigh
   Northwestern States
   Mason City.
3. Hawkeye, Des Moines.
   Pyramid, Valley Junction.
4. *Linwood, Davenport.

KANSAS

1. Kansas, Bonner Springs.
2. Great Western, Mildred.
3. Lehigh, Iola.
4. Monarch, Humboldt.
5. Fort Scott (N), Fort Scott.
6. Ash Grove, Chanute.
7. Fredonia, Fredonia.
8. Atlas, Independence.

KENTUCKY

1. Kosmos (also N), Kosmosdale.

MARYLAND

1. North American, Security.
2. Lehigh, Union Bridge.

MICHIGAN

1. Petoskey, Petoskey.
2. Huron, Alpena.
3. Newaygo, Newaygo.
4. Aetna, Bay City.
5. Aetna
   New Egyptian
   Fenton.
6. New Egyptian, Port Huron.
7. Alpha, Bellevue.
8. Peerless, Union City.
9. Wolverine, Coldwater and Quincy.
10. Peninsular, Cement City.
11. Michigan, Chelsea.
12. Wyandotte, Wyandotte.
13. Ford
    Peerless
    River Rouge.

MINNESOTA

1. Universal, Morgan Park.
2. Carney (N), Carney.
3. Carney (N), Mankato.
4. Austin (N), Austin.

MISSOURI

1. Missouri, Sugar Creek.
2. Atlas, Hannibal.
3. Missouri, Prospect Hill.
4. Alpha, St. Louis.
5. Marquette, Cape Girardeau.

MONTANA

1. Three Forks, Hanover.
2. Three Forks, Trident.

NEBRASKA

1. Nebraska, Superior.

NEW JERSEY

1. Vulcanite, Vulcanite
   Edison, New Village
   Lehigh district.

NEW YORK

1. Alpha, Jamesville.
2. Cayuga, Portland Point.
3. North American, Howes Cave.
4. Glens Falls, Glens Falls.
5. Acme, Catskill.
6. Knickerbocker
   Atlas
   Hudson.
7. Lehigh, Alsen.
8. Alpha, Cementon.
9. Snyder (N), Rosendale.
10. *Louisville (N), Akron.

OHIO

1. Sandusky, Silica.
2. Sandusky, Baybridge.
3. Castalia, Castalia.
4. Diamond, Middle Branch.
5. Lisbon (N), Lisbon.
6. Southwestern
   *Wabash
   Osborn.
7. Pittsburgh Plate Glass, Fultonham.
8. Wellston, Superior.
9. Alpha, Ironton.
10. Standard, Fairport.

OKLAHOMA

1. Dewey, Dewey.
2. Oklahoma, Ada.

OREGON

1. Oregon, Oswego.
2. Sun, Lime.
3. Beaver, Gold Hill.

PENNSYLVANIA

1. Allentown, Evansville.
   Alpha, Martins Creek.
   Atlas, Coplay and Northampton.
   Bath, Bath
   Coplay, Coplay
   Dexter, Nazareth
   Giant, Egypt and Lesley.
   Hercules, Stockertown.
   Lawrence (also N), Siegfried.
   Lehigh, Fogelsville, Ormrod, Sandts Eddy, and West Coplay.
   Nazareth, Nazareth
   Penn-Allen, Penn-Allen.
   Pennsylvania, Bath
   Phoenix, Nazareth
   Whitehall, Cementon
   Lehigh district.
2. Bessemer, Bessemer.
3. Lehigh, Newcastle.
4. Crescent, Wampum.
5. Universal, Universal.
6. Sandusky, York.

SOUTH DAKOTA

1. South Dakota State, Rapid City.

TENNESSEE

1. Hermitage, Nashville
2. Clinchfield, Kingsport.
3. Dixie, Richard City.
4. Signal Mountain, Chattanooga.

TEXAS

1. Trinity, Fort Worth.
2. Trinity, Eagle Ford.
   Texas, Cement.
3. Southwestern, El Paso.
4. San Antonio, San Antonio.
5. Texas, Manchester.

UTAH

1. Utah-Idaho, Bakers.
2. Union, Devils Slide.
3. Utah, Salt Lake City.

VIRGINIA

1. Lehigh, Fordwick.
2. Virginia, Norfolk.

WASHINGTON

1. Olympic, Bellingham.
2. Superior, Concrete.
3. Lehigh, Metaline Falls.
4. International, Irvin.

WEST VIRGINIA

1. Alpha, Manheim.

WISCONSIN

1. Manitowoc, Manitowoc.

* Under construction.

Portland cement through scientific investigation and public education. This association, in cooperation with the United States Government and the American Society for Testing Materials, has been largely responsible for the requirement that a cement in order to be in good standing shall meet the United States Government specification for Portland cement.

During the period of more than 16 years, in which the senior author of this chapter directed the preparation of the annual reports on the cement industry that were published in Mineral Resources by the United States Geological Survey, Department of the Interior, the production of Portland cement increased from about 65,000,000 barrels to nearly 150,000,000 barrels. In relinquishing this work because of its transfer to the Bureau of Mines, Department of Commerce, the author ventures to predict that the next 16 years will witness even greater growth in the Portland cement industry.

GENERAL REVIEW OF RECENT YEARS

Because of its interest in connection with the foregoing review of 100 years of progress in the Portland cement industry a graph comparing the output of Portland cement with the volume of all manufactures for the years 1911 to 1924, the period for which monthly statistics of cement production are available, follows. The curve for Portland cement has been constructed from the average daily production by months by taking the average for 1911 to 1913 as 100 per cent; the curve for manufactures has been drawn by taking the average for the years 1909 to 1913 as 100 per cent. This comparison was shown graphically in a paper[4] from which the following comments are quoted:

> The most notable feature of the curve showing production of cement is the wide seasonal variation. Except for this great seasonal change, which makes it somewhat difficult to interpret during the winter and early spring, the cement curve should be a useful barometer of business. It reflects, of course, the activity of construction, particularly road making. For this reason the cement industry was relatively depressed in 1918, when construction had to yield priority to the manufacture of war materials, into which cement did not enter in large volume. Conversely, when other industries were feeling the great depression of 1921 the cement mills were making new records. * * *.
>
> Cement making is also interesting as one of the few industries in which figures for producers' stocks are available over a long period. The demand for cement is even more seasonal than the production, as here shown. Shipments during the winter drop far below the low point of production and in like manner, during the summer, rise above the high point of production. The curve for stocks is the reverse of the curve for shipments.

A summary of the monthly estimates of output of Portland cement in 1924, compiled from the monthly reports of producers, was published early in January, 1925, by the United States Geological Survey. These estimates, which indicated a production of nearly 149,000,000 barrels and shipments of about 145,747,000 barrels, were within about 0.3 and 0.2 per cent, respectively, of the final figures for 1924.

In January, 1924, production was at a slightly higher rate and shipments were at a slightly lower rate than in January, 1923. During the active season, from May to October, production and ship-

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[4] Smith, George Otis, and others, Fluctuations in mineral output: Presented before the American Statistical Association at Washington, D. C., Dec. 28, 1923. Published with other papers on the problem of business forecasting, Boston and New York, 1924.

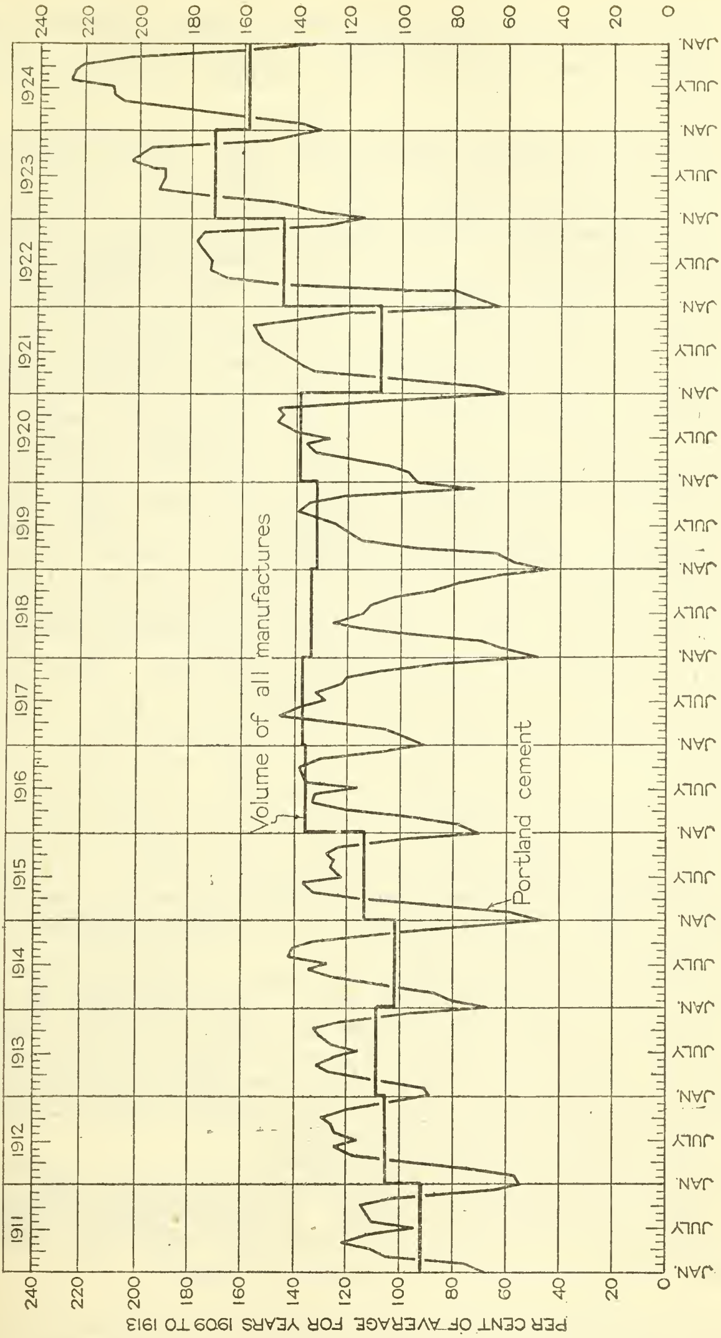

FIGURE 10.—Graphic comparison of the output of Portland cement with volume of all manufactures, 1911–1924

ments attained much higher levels than in 1923; in October, when stocks were lowest, there was more than 6,000,000 barrels of cement at the mills and more than twice that quantity at the end of most other months.

Portland cement manufacturers differed in their comments on trade conditions in 1924 as compared with 1923. In the Lehigh district those manufacturers who replied to inquiries said conditions were good, very good, or better than in 1923. Similar comment characterized most of the replies received from manufacturers in the States east of Mississippi River. In the Lehigh district railroad conditions were reported better; demand was reported very much greater due to building and increased road construction, but some plants noted slight recessions in price because of market conditions. In New York conditions in the northeastern part of the State appear to have been slightly better than elsewhere; building operations and State road work were reported active and railroad conditions better. In western Pennsylvania and Ohio conditions appear to have been satisfactory most of the time, but a labor strike and a storm caused brief shutdowns. In Michigan a large demand caused by increased building activities enabled several plants to run at full capacity except during the usual winter shutdown period; similar conditions prevailed in Indiana. In the States of Kentucky, Tennessee, Georgia, and Alabama demand was reported as ranging from about the same to very much better than in 1923. West of Mississippi River conditions seem to have been less uniformly satisfactory. The majority of plants in Missouri, Kansas, Oklahoma, and Colorado reported very little change as compared with 1923, but some plants in Kansas and Texas found trade better. In Texas favorable weather helped the industry. Iowa manufacturers generally reported a smaller demand due to the unfavorable financial condition of farmers in Iowa and adjacent States. Drought and general agricultural depression had an unfavorable effect on the Portland cement industry in parts of the Rocky Mountain and extreme Northwestern States. In the more populous centers of the Pacific coast demand for cement was nearly as great as in 1923, but many plants reported a loss of business through importations of European cement.

The following table summarizes the value of buildings shown by permits issued during 1921 to 1924 in 180 cities representing all parts of the United States; it illustrates the general trend of building construction during these years. The grand totals for the four years successively increased, and all districts showed increases throughout the four years except the central and northern great plains States and California, which showed decreases in 1924.

The other table summarizes the value of contracts awarded for buildings of all classes and for engineering construction work of all other kinds, including public works. The net increase in 1924 for construction work of all kinds was considerably higher than that for buildings alone.

Value of buildings shown by permits issued in 180 cities in the United States, 1921–1924 [a]

Group of cities	1921	1922	1923	1924	Increase or decrease, 1924 from 1923 (per cent)
New England	$84, 907, 000	$152, 680, 000	$153, 820, 000	$183, 078, 000	+19
New York and northern New Jersey	562, 755, 000	773, 747, 000	983, 772, 000	1, 062, 275, 000	+8
Eastern Pennsylvania, southern New Jersey, Maryland, Delaware, District of Columbia, and Virginia	143, 081, 000	287, 528, 000	303, 717, 000	330, 657, 000	+9
Western Pennsylvania, West Virginia, Ohio, and Kentucky	146, 805, 000	214, 628, 000	243, 146, 000	255, 201, 000	+5
Illinois, Indiana, Iowa, Wisconsin, Michigan, Missouri, Kansas, Nebraska, and Oklahoma	341, 117, 000	556, 604, 000	726, 319, 000	711, 075, 000	−2
Minnesota, North Dakota, and South Dakota	45, 311, 000	65, 671, 000	80, 562, 000	55, 912, 000	−31
North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Tennessee, Arkansas, and Louisiana	79, 630, 000	119, 858, 000	145, 621, 000	169, 240, 000	+16
Arizona and Texas	46, 830, 000	55, 205, 000	64, 974, 000	73, 468, 000	+13
Colorado, Utah, Montana, and Idaho	16, 327, 000	25, 911, 000	31, 627, 000	34, 041, 000	+8
California, Washington, and Oregon	201, 989, 000	302, 006, 000	408, 351, 000	383, 059, 000	−6
	1, 668, 752, 000	2, 553, 838, 000	3, 141, 909, 000	3, 258, 006, 000	+4

[a] From Bulletin of Portland Cement Association showing values tabulated in detail by cities, based on Bradstreet's and American Contractor building statistics.

Value of contracts awarded for building and all other construction work in eastern and central States, 1921–1924 [a]

Group of States	1921	1922	1923	1924	Increase or decrease, 1924 from 1923 (per cent)
New England	$205, 147, 000	$333, 572, 000	$332, 857, 000	$352, 195, 000	+6
New York and northern New Jersey	645, 418, 000	891, 321, 000	1, 068, 935, 000	1, 329, 396, 000	+24
Eastern Pennsylvania, southern New Jersey, Maryland, Delaware, District of Columbia, and Virginia	306, 557, 000	418, 869, 000	374, 182, 000	477, 746, 000	+28
Western Pennsylvania, West Virginia, Ohio, and Kentucky	396, 075, 000	534, 575, 000	593, 994, 000	578, 365, 000	−3
Illinois, Indiana, Iowa, Wisconsin, Michigan, Missouri, Kansas, Nebraska, and Oklahoma	695, 515, 000	1, 048, 329, 000	1, 006, 422, 000	1, 049, 586, 000	+4
Minnesota, North and South Dakota, and northern Michigan	85, 101, 000	78, 564, 000	127, 336, 000	88, 264, 000	−31
North and South Carolina, Georgia, Florida, Alabama, Mississippi, Tennessee, Arkansas, and Louisiana	([b])	([b])	486, 757, 000	606, 255, 000	+25
	[c] 2,333,813,000	[c] 3,305,230,000	3, 990, 483, 000	4, 481, 807, 000	+12

[a] From Bulletin of Portland Cement Association based on compilations by F. W. Dodge Co.
[b] No statistics available prior to 1923.
[c] Exclusive of southeastern States.

CHIEF HYDRAULIC CEMENTS

The shipments of Portland and other (masonry, natural, and puzzolan) cements from the mills in the United States in 1924 increased more than 7 per cent in quantity and more than 2 per cent in value over the shipments in 1923.

Hydraulic cements shipped from mills in the United States, 1922–1924

Class	1922		1923		1924	
	Barrels	Value	Barrels	Value	Barrels	Value
Portland	117, 701, 216	$207, 170, 430	135, 912, 118	$257, 684, 424	146, 047, 549	$264, 046, 708
Masonry, natural, and puzzolan	889, 428	1, 293, 598	1, 271, 674	1, 947, 352	1, 418, 461	2, 006, 559
	118, 590, 644	208, 464, 028	137, 183, 792	259, 631, 776	147, 466, 010	266, 053, 267

The abridged historical table on page 358 gives the production and value of natural, Portland, and puzzolan cements for more than 100 years. The curves in Figure 11 show graphically some of these data from 1890 to 1924.

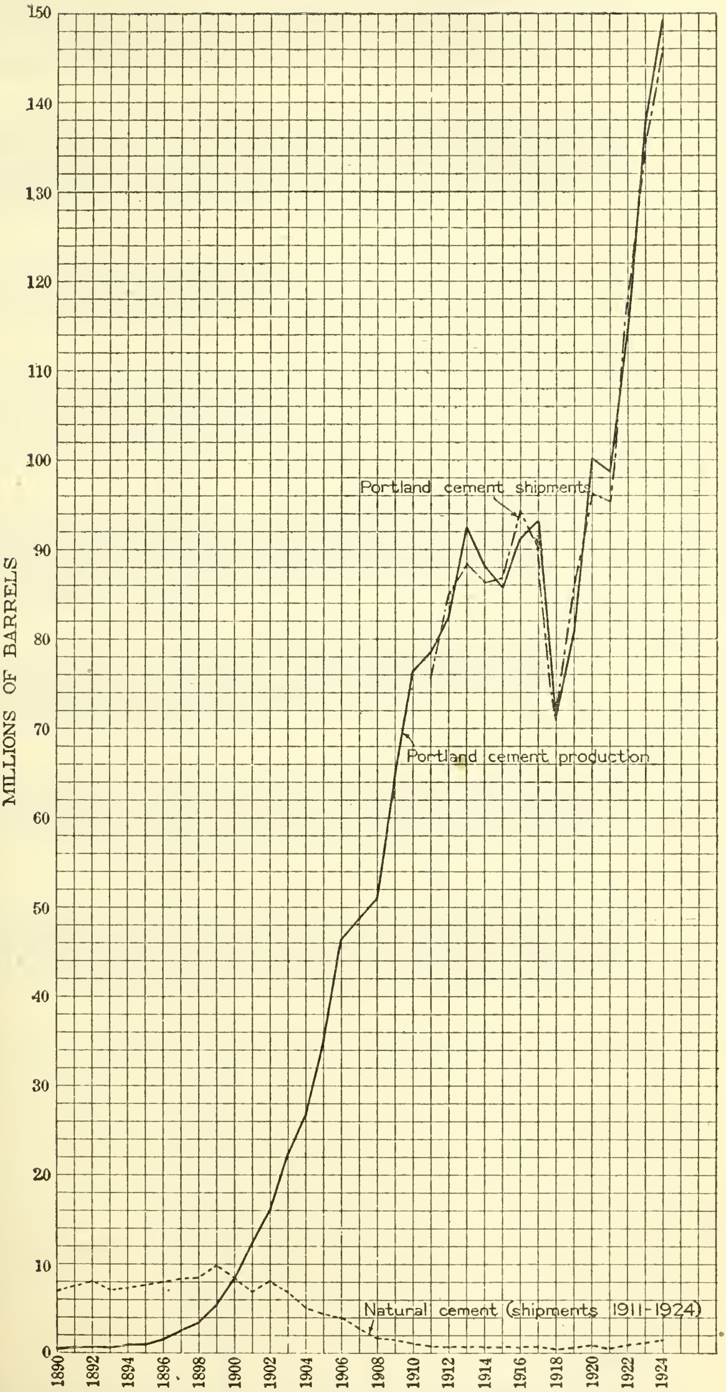

FIGURE 11.—Production of Portland and natural cements, 1890–1924, and shipments of Portland cement, 1911–1924

Principal hydraulic cements produced [a] in the United States, 1818–1924

Year	Natural cement [a]		Portland cement		Puzzolan cement [a]		Total	
	Barrels	Value	Barrels	Value [b]	Barrels	Value	Barrels	Value [b]
1818–1829	300, 000	$246, 000	----------	----------	----------	----------	300, 000	$246, 000
1830–1839	1, 000, 000	850, 000	----------	----------	----------	----------	1, 000, 000	850, 000
1840–1849	4, 250, 000	3, 612, 500	----------	----------	----------	----------	4, 250, 000	3, 612, 500
1850–1859	11, 000, 000	9, 350, 000	----------	----------	----------	----------	11, 000, 000	9, 350, 000
1860–1869	16, 420, 000	13, 957, 000	----------	----------	----------	----------	16, 420, 000	13, 957, 000
1870–1879	22, 000, 000	18, 700, 000	82, 000	$246, 000	----------	----------	22, 082, 000	18, 946, 000
1880	2, 030, 943	1, 726, 707	42, 000	126, 000	----------	----------	2, 072, 943	1, 852, 707
1881	2, 440, 000	2, 379, 000	60, 000	150, 000	----------	----------	2, 500, 000	2, 529, 000
1882	3, 165, 000	3, 481, 500	85, 000	191, 250	----------	----------	3, 250, 000	3, 672, 750
1883	4, 100, 000	4, 100, 000	90, 000	193, 500	----------	----------	4, 190, 000	4, 293, 500
1884	3, 900, 000	3, 510, 000	100, 000	210, 000	----------	----------	4, 000, 000	3, 720, 000
1885	4, 000, 000	3, 200, 000	150, 000	292, 500	----------	----------	4, 150, 000	3, 492, 500
1886	4, 350, 000	3, 697, 500	150, 000	292, 500	----------	----------	4, 500, 000	3, 990, 000
1887	6, 692, 744	5, 186, 877	250, 000	487, 500	----------	----------	6, 942, 744	5, 674, 377
1888	6, 253, 295	4, 533, 639	250, 000	487, 500	----------	----------	6, 503, 295	5, 021, 139
1889	6, 531, 876	4, 702, 951	300, 000	500, 000	----------	----------	6, 831, 876	5, 202, 951
1890	7, 441, 116	3, 822, 501	335, 500	704, 050	----------	----------	7, 776, 616	4, 526, 551
1891 [c]	7, 767, 979	3, 671, 147	454, 813	967, 679	----------	----------	8, 222, 792	4, 638, 826
1892	8, 211, 181	3, 991, 455	547, 440	1, 152, 600	----------	----------	8, 758, 621	5, 144, 055
1893	7, 411, 815	3, 251, 757	590, 652	1, 158, 138	----------	----------	8, 002, 467	4, 409, 895
1894	7, 563, 488	3, 635, 731	798, 757	1, 383, 473	----------	----------	8, 362, 245	5, 019, 204
1895	7, 741, 077	3, 895, 424	990, 324	1, 586, 830	----------	----------	8, 731, 401	5, 482, 254
1896	7, 970, 450	4, 049, 202	1, 543, 023	2, 424, 011	12, 265	$12, 250	9, 525, 738	6, 485, 463
1897	8, 311, 688	3, 862, 392	2, 677, 775	4, 315, 891	48, 329	48, 500	11, 037, 792	8, 226, 783
1898	8, 418, 924	3, 888, 728	3, 692, 284	5, 970, 773	233, 000	198, 050	12, 344, 208	10, 057, 551
1899	9, 868, 179	4, 814, 771	5, 652, 266	8, 074, 371	335, 000	268, 000	15, 855, 445	13, 157, 142
1900	8, 383, 519	3, 728, 848	8, 482, 020	9, 280, 525	365, 611	274, 208	17, 231, 150	13, 283, 581
1901	7, 084, 823	3, 056, 278	12, 711, 225	12, 532, 360	272, 689	198, 151	20, 068, 737	15, 786, 789
1902	8, 044, 305	4, 076, 630	17, 230, 644	20, 864, 078	478, 555	425, 672	25, 753, 504	25, 366, 380
1903	7, 030, 271	3, 675, 520	22, 342, 973	27, 713, 319	525, 896	542, 502	29, 899, 140	31, 931, 341
1904	4, 866, 331	2, 450, 150	26, 505, 881	23, 355, 119	303, 045	226, 651	31, 675, 257	26, 031, 920
1905	4, 473, 049	2, 413, 052	35, 246, 812	33, 245, 867	382, 447	272, 614	40, 102, 308	35, 931, 533
1906	4, 055, 797	2, 423, 170	46, 463, 424	52, 466, 186	481, 224	412, 921	51, 000, 445	55, 302, 277
1907	2, 887, 700	1, 467, 302	48, 785, 390	53, 992, 551	557, 252	443, 998	52, 230, 342	55, 903, 851
1908	1, 686, 862	834, 509	51, 072, 612	43, 547, 679	151, 451	95, 468	52, 910, 925	44, 477, 656
1909	1, 537, 638	652, 756	64, 991, 431	52, 858, 354	160, 646	99, 453	66, 689, 715	53, 610, 563
1910	1, 139, 239	483, 006	76, 549, 951	68, 205, 800	95, 951	63, 286	77, 785, 141	68, 752, 092
1911	926, 091	378, 533	78, 528, 637	66, 248, 817	93, 230	77, 786	79, 547, 958	66, 705, 136
1912	821, 231	367, 222	82, 438, 096	67, 016, 928	91, 864	77, 363	83, 351, 191	67, 461, 513
1913	744, 658	345, 889	92, 097, 131	92, 557, 617	107, 313	97, 663	92, 949, 102	93, 001, 169
1914	751, 285	351, 370	88, 230, 170	81, 789, 368	68, 311	63, 358	89, 049, 766	82, 204, 096
1915	750, 863	358, 627	85, 914, 907	73, 886, 820	42, 678	39, 801	86, 708, 448	74, 285, 248

1916	[d] 842, 137	[d] 430, 874	91, 521, 198	100, 947, 881	([d])	([d])	92, 363, 335	101, 378, 755
1917	[d] 639, 456	[d] 435, 370	92, 814, 202	125, 670, 430	([d])	([d])	93, 453, 658	126, 105, 800
1918	[d] 432, 966	[d] 401, 341	71, 081, 663	113, 730, 661	([d])	([d])	71, 514, 629	114, 132, 002
1919	[d] 528, 589	[d] 583, 554	80, 777, 935	138, 130, 269	([d])	([d])	81, 306, 524	138, 713, 823
1920	[d] 767, 481	[d] 1, 150, 890	100, 023, 245	202, 046, 955	([d])	([d])	100, 790, 726	203, 197, 845
1921	[d] 539, 402	[d] 897, 025	98, 842, 049	186, 811, 473	([d])	([d])	99, 381, 451	187, 708, 498
1922	[d] 889, 428	[d] 1, 293, 598	114, 789, 984	202, 030, 372	([d])	([d])	115, 679, 412	203, 323, 970
1923	[d] 1, 271, 674	[d] 1, 947, 352	137, 460, 238	261, 174, 452	([d])	([d])	138, 731, 912	263, 121, 804
1924	[d] 1, 418, 461	[d] 2, 006, 559	149, 358, 109	270, 338, 177	([d])	([d])	150, 776, 570	272, 344, 736
	[d] 241, 653, 011	[d] 158, 326, 207	1, 793, 101, 761	2, 411, 356, 624	[d] 4, 806, 757	[d] 3, 937, 695	2, 039, 561, 529	2, 573, 620, 526

[a] For 1912 and later years the figures for natural and puzzolan cements represent shipments. Figures for production are not available.

[b] For 1913 and later years the values given for the production of Portland cement in the United States have been calculated at the average value of shipments.

[c] The figures for 1890 and previous years are estimates made at the close of each year and are believed to be substantially correct. For years since 1890 the official figures are based on practically complete returns from all producers.

[d] Figures for puzzolan cement from 1916 to 1924, inclusive, are included with natural cement.

PORTLAND CEMENT

PRODUCTION, SHIPMENTS, AND STOCKS

The total output of Portland cement in the United States in 1924 showed an increase of 9 per cent over that in 1923. Shipments from the mills increased 7 per cent in quantity and 2 per cent in gross value. The average factory value decreased 9 cents a barrel, or nearly 5 per cent. The production of 149,358,109 barrels of 376 pounds net is equivalent to 597,432,436 sacks, 25,070,825 long tons, or 28,079,324 short tons.

The statistics in the following table are arranged by States, so far as possible. The term "active plant" is applied to a mill or to a group of mills situated at one place and operated by one company, but if a company has establishments at different places its mill or group of mills at each place is counted as a plant. In the table by districts the statistics are for groups of States, or parts of States, that are geographically and commercially related.

South Dakota and Wisconsin with one new plant each were included in 1924 for the first time in the list of producing States. Of the 27 other States in which Portland cement was manufactured in 1924 all but 8 showed increases in production, and all but 6 showed increases in shipments as compared with 1923. All the commercial districts except Colorado-Utah and Oregon-Washington-Montana showed increases in production and all but the last named showed increases in shipments; the gains in production ranged from 1 to 44 per cent and in shipments from 0.1 to 49 per cent. The net change for the whole country was an increase of 9 per cent in production and of 7 per cent in shipments. In 1924 production exceeded shipments by 3,310,560 barrels.

The statistical tables show very large increases in production in certain States or districts—for instance, in Alabama there was a gain of 59 per cent, and in the district in which this State is situated there was a gain of 44 per cent. In this district another new mill, situated in Tennessee (see p. 373), began producing early in the year. In Michigan, where the initial production of another plant was recorded, there was a gain of 22 per cent. In other States, such as California and Ohio, the production was increased by the building of new mills. The increase in output where no new mills were built was, as a rule, due to larger manufacturing capacity facilities, stimulated, no doubt, by the growth in projected road-building and construction work.

Portland cement produced, shipped, and in stock in the United States, 1923 and 1924, by States

State	Production					Shipments							Stock		
	Active plants		Barrels		Increase or decrease, 1924 (per cent)	1923		1924		Average factory value per barrel		Increase or decrease in quantity, 1924 (per cent)	Barrels		Increase, 1924 (per cent)
	1923	1924	1923	1924		Barrels	Value	Barrels	Value	1923	1924		1923 (revised)	1924	
Alabama	5	5	3, 497, 256	5, 552, 550	+59	3, 395, 392	$6, 257, 673	5, 542, 687	$9, 147, 367	$1. 84	$1. 65	+63	136, 765	146, 628	7
California	9	10	11, 001, 910	11, 615, 379	+6	10, 882, 802	26, 022, 156	11, 481, 730	25, 532, 707	2. 39	2. 22	+6	369, 035	502, 684	36
Illinois	4	4	7, 147, 906	6, 994, 323	−2	7, 129, 208	12, 550, 100	6, 955, 455	12, 026, 310	1. 76	1. 73	−2	661, 942	700, 810	6
Iowa	5	5	5, 732, 470	5, 624, 466	−2	5, 570, 675	10, 351, 971	4, 881, 613	8, 811, 587	1. 86	1. 81	−12	952, 240	1, 695, 093	78
Kansas	7	7	6, 025, 657	5, 894, 236	−2	5, 878, 839	10, 868, 590	5, 809, 646	9, 900, 547	1. 85	1. 70	−1	768, 860	853, 450	11
Michigan	14	15	7, 619, 792	9, 259, 781	+22	7, 466, 283	14, 038, 322	8, 991, 270	16, 405, 761	1. 88	1. 82	+20	782, 377	1, 050, 888	34
Missouri	5	5	7, 305, 997	7, 871, 621	+8	7, 143, 883	13, 237, 141	7, 711, 206	13, 515, 267	1. 85	1. 75	+8	774, 922	935, 337	21
New York	9	9	6, 990, 174	7, 571, 856	+8	6, 853, 062	12, 834, 471	7, 435, 875	13, 460, 594	1. 87	1. 81	+9	653, 263	789, 244	21
Ohio	6	7	4, 188, 755	4, 600, 835	+10	4, 003, 321	7, 615, 741	4, 298, 027	7, 836, 325	1. 90	1. 82	+7	353, 782	656, 590	86
Pennsylvania	22	22	38, 157, 482	40, 849, 602	+7	38, 610, 852	69, 792, 343	40, 208, 860	69, 693, 517	1. 81	1. 73	+4	2, 121, 365	2, 762, 107	30
Texas	5	5	4, 178, 895	4, 565, 983	+9	4, 091, 284	8, 011, 226	4, 488, 143	8, 322, 658	1. 96	1. 85	+10	278, 372	356, 212	28
Washington	4	4	2, 105, 711	1, 842, 113	−13	2, 111, 479	4, 988, 022	1, 793, 403	4, 236, 554	2. 36	2. 36	−15	240, 892	289, 602	20
Other States [a]	31	34	33, 508, 233	37, 115, 364	+11	32, 775, 038	61, 116, 668	36, 449, 634	65, 157, 514	1. 86	1. 79	+11	2, 718, 824	3, 384, 554	24
	126	132	137, 460, 238	149, 358, 109	+9	135, 912, 118	257, 684, 424	146, 047, 549	264, 046, 708	1. 90	1. 81	+7	10, 812, 639	14, 123, 199	31

[a] 1923: Colorado, Georgia, Indiana, Kentucky, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, Tennessee, Utah, Virginia, and West Virginia; 1924: Same States as in 1923, with South Dakota which began producing in December and Wisconsin which began producing and shipping in June in addition.

Portland cement produced, shipped, and in stock in the United States, 1923 and 1924, by districts

Commercial district	Production					Shipments							Stock		
	Active plants		Barrels		Increase or decrease, 1924 (per cent)	1923		1924		Average factory value per barrel		Increase or decrease in quantity, 1924 (per cent)	Barrels		Increase, 1924 (per cent)
	1923	1924	1923	1924		Barrels	Value	Barrels	Value	1923	1924		1923 (revised)	1924	
Eastern Pennsylvania, New Jersey, and Maryland	22	22	35, 721, 751	38, 656, 739	+8	36, 133, 963	$65, 536, 543	37, 989, 250	$65, 500, 657	$1. 81	$1. 72	+5	1, 877, 051	2, 544, 540	36
New York	9	9	6, 990, 174	7, 571, 856	+8	6, 853, 062	12, 834, 471	7, 435, 875	13, 460, 594	1. 87	1. 81	+9	653, 263	789, 244	21
Ohio, western Pennsylvania, and West Virginia	11	12	13, 495, 799	14, 331, 451	+6	13, 211, 380	24, 183, 471	14, 028, 762	25, 104, 849	1. 83	1. 79	+6	1, 067, 227	1, 369, 916	28
Michigan	14	15	7, 619, 792	9, 259, 781	+22	7, 466, 283	14, 038, 322	8, 991, 270	16, 405, 761	1. 88	1. 82	+20	782, 377	1, 050, 888	34
Wisconsin,[a] Illinois, Indiana, and Kentucky	10	11	21, 193, 666	21, 823, 469	+3	21, 056, 914	37, 010, 579	21, 343, 396	37, 189, 604	1. 76	1. 74	+1	1, 571, 161	2, 051, 234	31
Virginia, Tennessee, Alabama, and Georgia	11	12	7, 908, 846	11, 411, 054	+44	7, 620, 850	14, 210, 617	11, 374, 280	19, 201, 389	1. 86	1. 69	+49	457, 593	494, 367	8
Eastern Missouri, Iowa, Minnesota, and South Dakota[b]	10	11	14, 037, 099	14, 822, 738	+6	13, 624, 173	25, 022, 674	13, 984, 167	24, 757, 538	1. 84	1. 77	+3	1, 905, 675	2, 744, 246	44
Western Missouri, Nebraska, Kansas, and Oklahoma	11	11	9, 779, 034	9, 892, 813	+1	9, 573, 003	18, 185, 384	9, 586, 984	16, 262, 422	1. 90	1. 70	+. 1	1, 163, 033	1, 468, 862	26
Texas	5	5	4, 178, 895	4, 565, 983	+9	4, 091, 284	8, 011, 226	4, 488, 143	8, 322, 658	1. 96	1. 85	+10	278, 372	356, 212	28
Colorado and Utah	5	5	2, 427, 971	2, 423, 830	—. 2	2, 340, 386	5, 163, 340	2, 377, 774	5, 081, 599	2. 21	2. 14	+2	269, 934	315, 990	17
California	9	10	11, 001, 910	11, 615, 379	+6	10, 882, 802	26, 022, 156	11, 481, 730	25, 532, 707	2. 39	2. 22	+6	369, 035	502, 684	36
Oregon, Washington, and Montana	9	9	3, 105, 301	2, 983, 016	—4	3, 058, 018	7, 465, 641	2, 965, 918	7, 226, 930	2. 44	2. 44	—3	417, 918	435, 016	4
	126	132	137, 460, 238	149, 358, 109	+9	135, 912, 118	257, 684, 424	146, 047, 549	264, 046, 708	1. 90	1. 81	+7	10, 812, 639	14, 123, 199	31

[a] Began producing and shipping June, 1924.

[b] South Dakota began producing December, 1924.

Figure 12 shows graphically the monthly and seasonal fluctuations in output.

The accompanying table, which shows production, shipments, and stocks by months for 1923 and 1924, has been compiled from monthly reports of producers but includes estimates for the output of one or two plants each month. Although the figures only approximate the totals shown in other tables of this report that are based on final annual reports from the producers, they reflect the fluctuations in the industry during the year. Production of Portland cement is necessarily curtailed to some extent in December, January, and February in the colder parts of the United States at plants using marl as a raw material and at other plants where the wet process is employed, and numerous other mills close for repairs in the winter when demand is lowest. Movements are on foot to create a steadier demand for cement, but it will be hard to overcome the difficulties of construction work during winter in northern cities. In connection with the stock of finished cement available by months throughout the year the quantity of clinker or unground cement, also in reserve at the mills, is of interest, and the table appended shows these quantities as estimated by the manufacturers.

Estimated production, shipments, and mill stocks of Portland cement in the United States, 1923 and 1924, by months, in barrels

Month	1923			1924		
	Production	Shipments	Stocks on last day of the month	Production	Shipments	Stocks on last day of the month
January	7,990,000	5,628,000	11,477,000	8,788,000	5,210,000	14,155,000
February	8,210,000	6,090,000	13,596,000	8,588,000	5,933,000	16,815,000
March	9,880,000	10,326,000	13,045,000	10,370,000	8,995,000	18,189,000
April	11,359,000	12,954,000	11,463,000	11,726,000	12,771,000	17,159,000
May	12,910,000	14,257,000	10,144,000	13,777,000	14,551,000	16,403,000
June	12,382,000	13,307,000	9,168,000	13,538,000	15,036,000	14,903,000
July	12,620,000	13,712,000	8,081,000	14,029,000	16,614,000	12,319,000
August	12,967,000	14,971,000	6,080,000	15,128,000	16,855,000	10,666,000
September	13,109,000	13,698,000	5,533,000	14,519,000	16,827,000	8,404,000
October	13,350,000	14,285,000	4,612,000	14,820,000	17,160,000	6,073,000
November	12,603,000	10,251,000	6,991,000	13,141,000	10,289,000	8,928,000
December	9,997,000	6,408,000	[a]10,813,000	10,435,000	5,506,000	14,123,000

[a] Revised figures.

Estimated clinker, or unground cement, at the mills in the United States at the end of each month, 1923 and 1924, in barrels

Month	1923	1924	Month	1923	1924
January	4,015,000	5,458,000	July	3,865,000	6,646,000
February	4,646,000	6,905,000	August	3,759,000	5,367,000
March	5,174,000	8,271,000	September	3,379,000	4,260,000
April	5,006,000	8,545,000	October	3,008,000	3,548,000
May	4,470,000	8,225,000	November	2,908,000	4,025,000
June	4,172,000	7,609,000	December	3,783,000	5,433,000

Portland cement shipped from mills in the United States, 1919–1924

Year	Barrels	Value	Year	Barrels	Value
1919	85,612,899	$146,734,844	1922	117,701,216	$207,170,430
1920	96,311,719	194,439,025	1923	135,912,118	257,684,424
1921	95,507,147	180,778,415	1924	146,047,549	264,046,708

The stock of Portland cement reported on hand at the mills at the end of 1924 showed an increase of 31 per cent over that at the end of 1923 and was in excess of the average for the five preceding years (9,289,485 barrels). In fact, the stocks at the end of 1924 were the greatest at the end of any year during which official records of stocks have been kept. The totals by States and districts are shown in preceding tables.

Finished Portland cement in stock at mills in the United States, December 31, 1919–1924, in barrels

1919	5, 256, 900	1922	9, 352, 250
1920	8, 833, 067	1923	[5] 10, 812, 639
1921	12, 192, 567	1924	14, 123, 199

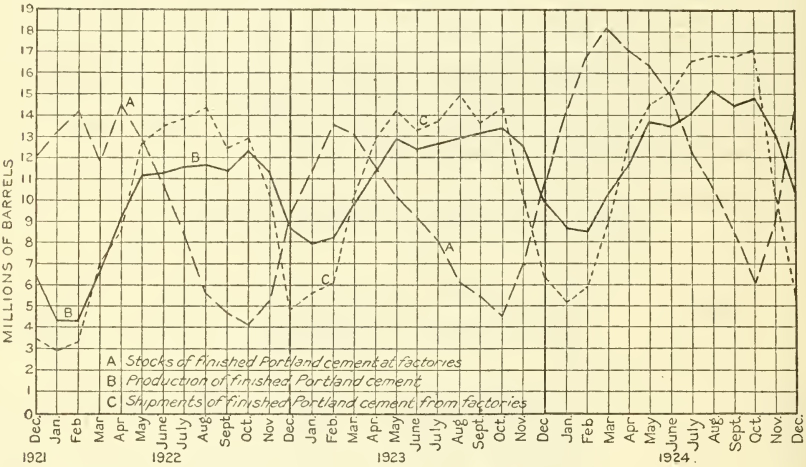

FIGURE 12.—Monthly fluctuations in production, shipments, and stocks of finished Portland cement, 1922-1924

DOMESTIC CONSUMPTION

The total consumption of Portland cement in the United States may be estimated by adding the imports to the shipments and subtracting the exports from the sum. Of course, at all times a variable but considerable stock of cement is in transit, in warehouses at distributing points, and awaiting use at jobs, so that the estimate thus made is at best only approximate. Still another uncertain element in this estimate is that the cement imported and exported is classed as hydraulic cement, hence the records do not discriminate between Portland and other cements and probably include some plaster also. Portland cement, however, constitutes by far the greater part of the exports. The apparent domestic consumption in 1924 showed an increase of 8 per cent as compared with the consumption in 1923.

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[5] Revised figures.

Portland cement available for consumption in the United States, 1919–1924, in barrels

Year	Shipments	Imports	Exports	Available for consumption
1919	85,612,899	8,931	2,463,573	83,158,257
1920	96,311,719	524,604	2,985,807	93,850,516
1921	95,507,147	122,322	1,181,014	94,448,455
1922	117,701,216	323,823	1,127,845	116,897,194
1923	135,912,118	1,678,636	1,001,688	136,589,066
1924	146,047,549	2,010,936	878,543	147,179,942

Furthermore, the estimates of consumption of Portland cement are merely approximate, because they represent only the records of shipments by manufacturers into the several States. The shipments of cement into a State during a year may not equal the consumption in that State during the same year, but shipments over a long period should afford a very fair index of consumption. The simplest available common unit is the estimated consumption, in barrels, per capita, which is obtained by comparing the shipments into States with the population of the States. The following table shows such figures for 1923 and 1924. The estimates of population used in calculating the per capita consumption were furnished by the Bureau of the Census.

The official figures for exports of cement, as given on page 378, differ from the exports reported by manufacturers, as shown in the following table, because cement forwarded from mills and destined for foreign countries and for Alaska, Hawaii, and Porto Rico, is reported by the shipper as exported, whether or not it leaves the country during that calendar year, but the Bureau of Foreign and Domestic Commerce bases its export figures on its records of the cement that actually leaves the country. (Shipments to Alaska, Hawaii, and Porto Rico are given on p. 379.) The exports given by that bureau for 1924 include all other hydraulic cement exported, whereas the table of per capita consumption relates only to Portland cement.

The per capita consumption shown by the table necessarily falls short of the total apparent consumption by the quantity of the imports. These increase the consumption in certain States near the Canadian border and in those having seaports; in 1924 they increased the general average per capita consumption by about 0.018 barrel.

There were 28 States in which the per capita consumption in 1924 was 1 barrel or more—13 of them west and 15 of them east of Mississippi River. Two of them are Southern States.

The highest per capita consumption in 1924 was that of California, 2.73 barrels. This State also held the record in 1923—2.69 barrels. There were two other States—Michigan and Florida—in which the per capita consumption in 1924 was 2 barrels or more. These two States also showed the largest per capita increases of the year.

There were changes in all the States—27 showed increases and 22 decreases. Most of the decreases were slight. The general average consumption was 1.29 barrels, compared with 1.21 barrels in 1923. This is the highest average per capita consumption for the United States ever recorded, the range from 1914 to 1923 having been from 0.64 to 1.21 barrels.[6]

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[6] Data on per capita consumption of Portland cement by States beginning with the year 1914 are given in preceding volumes of Mineral Resources.

Shipments of domestic Portland cement from mills into States and per capita, 1923 and 1924, in barrels [a]

State	1923		1924	
	Total	Per capita [a]	Total	Per capita [a]
Alabama	1, 489, 531	0. 61	1, 872, 997	0. 76
Arizona [b]	485, 544	1. 25	415, 146	1. 04
Arkansas [b]	848, 509	. 46	1, 084, 020	. 59
California	10, 373, 163	2. 69	10, 846, 703	2. 73
Colorado	1, 106, 920	1. 11	1, 337, 466	1. 32
Connecticut [b]	1, 441, 271	. 97	1, 582, 312	1. 04
Delaware [b]	404, 996	1. 75	385, 581	1. 65
District of Columbia [b]	756, 723	1. 57	722, 960	1. 47
Florida [b]	1, 299, 746	1. 23	2, 177, 233	2. 02
Georgia	1, 424, 552	. 47	1, 408, 106	. 46
Idaho [b]	291, 029	. 61	262, 422	. 54
Illinois	12, 237, 478	1. 79	13, 328, 219	1. 93
Indiana	5, 010, 588	1. 66	5, 522, 818	1. 81
Iowa	3, 624, 857	1. 46	3, 144, 001	1. 26
Kansas	2, 613, 070	1. 45	2, 142, 725	1. 18
Kentucky	1, 566, 682	. 63	1, 763, 538	. 71
Louisiana [b]	1, 028, 520	. 55	1, 260, 231	. 67
Maine [b]	510, 339	. 66	386, 593	. 49
Maryland	1, 827, 684	1. 21	1, 989, 182	1. 30
Massachusetts [b]	3, 124, 238	. 77	3, 359, 553	. 82
Michigan	7, 531, 664	1. 87	9, 355, 024	2. 28
Minnesota	3, 414, 916	1. 36	3, 248, 369	1. 28
Mississippi [b]	457, 907	. 26	527, 046	. 29
Missouri	3, 492, 453	1. 01	3, 985, 049	1. 15
Montana	280, 682	. 45	202, 782	. 32
Nebraska	1, 497, 040	1. 12	1, 499, 998	1. 11
Nevada [b]	92, 760	1. 20	91, 821	1. 19
New Hampshire [b]	359, 574	. 80	378, 554	. 84
New Jersey	5, 400, 703	1. 58	6, 410, 037	1. 84
New Mexico [b]	222, 482	. 59	231, 970	. 61
New York	15, 881, 436	1. 46	17, 456, 377	1. 58
North Carolina [b]	3, 108, 367	1. 15	2, 999, 559	1. 09
North Dakota [b]	302, 734	. 45	248, 732	. 36
Ohio	8, 843, 641	1. 43	9, 262, 652	1. 48
Oklahoma	2, 120, 313	. 97	2, 210, 586	1. 00
Oregon	956, 320	1. 15	1, 211, 462	1. 44
Pennsylvania	11, 281, 290	1. 23	12, 964, 163	1. 40
Rhode Island [b]	509, 584	. 81	608, 355	. 96
South Carolina [b]	626, 912	. 36	570, 631	. 32
South Dakota [c]	564, 807	. 86	466, 725	. 70
Tennessee	1, 267, 245	. 53	1, 558, 825	. 65
Texas	3, 328, 619	. 67	3, 853, 698	. 76
Utah	476, 186	. 99	427, 825	. 88
Vermont [b]	234, 182	. 66	300, 102	. 85
Virginia	1, 742, 200	. 72	1, 701, 408	. 70
Washington	1, 926, 019	1. 33	1, 730, 483	1. 18
West Virginia	1, 817, 112	1. 16	1, 661, 042	1. 05
Wisconsin [c]	5, 064, 404	1. 84	4, 515, 256	1. 62
Wyoming [b]	348, 805	1. 63	331, 309	1. 51
Unspecified	87, 516	----------	59, 899	----------
	134, 703, 313	1. 21	145, 061, 545	1. 29
Exports reported by manufacturers but not included above [d]	1, 208, 805	----------	986, 004	----------
Total shipped from cement plants	135, 912, 118	----------	146, 047, 549	----------

[a] Per capita figures based on estimate of population made by Bureau of the Census.

[b] Noncement-producing State.

[c] South Dakota began producing December, 1924, and shipping January, 1925; Wisconsin began producing and shipping June, 1924.

[d] Includes shipments to Alaska, Hawaii, and Porto Rico.

LOCAL SUPPLIES

By comparing the shipments from the mills within a State or group of States with the estimated consumption in the same area it is possible to ascertain the surplus or deficiency in the supply of cement locally available. The following table has been arranged with that end in view; the consumption in the noncement-producing States is shown in the preceding table. Data for 1916 to 1922 will be found in Mineral Resources of the United States for 1917 to 1922.

The surplus shown in the following table was distributed by years as follows: In 1923, to noncement-producing States, 22,083,433 barrels; to foreign countries and to Alaska, Hawaii, and Porto Rico, 1,208,805 barrels; unspecified, 87,516 barrels; in 1924, to noncement-producing States, 18,390,855 barrels; to foreign countries and to Alaska, Hawaii, and Porto Rico, 986,004 barrels; unspecified, 59,899 barrels.

Among the cement-producing States there are, of course, fewer deficiencies than surpluses, and certain of the deficiencies indicated are due to local conditions that did not change materially from 1923 to 1924. For instance, in 1924 Ohio showed a deficiency of more than 4,964,000 barrels, which was largely supplied from Pennsylvania's surplus of more than 27,200,000 barrels and from Indiana. New York, though a large producer, had a deficiency of more than 10,000,000 barrels that was mostly supplied from the Lehigh district in Pennsylvania. In Maryland, New Jersey, and West Virginia there was a shortage of more than 2,500,000 barrels that was probably supplied in large part from the Lehigh district. The quantities consumed in the nonproducing States are of interest in comparison with the other data. Between 500,000 and 1,000,000 barrels were consumed in 1924 in each of the States of Mississippi, Rhode Island, and South Carolina, and in the District of Columbia. Arkansas consumed more than 1,000,000 barrels, Louisiana more than 1,260,000 barrels, Connecticut nearly 1,600,000 barrels, Florida nearly 2,200,000 barrels, North Carolina nearly 3,000,000 barrels, and Massachusetts more than 3,300,000 barrels.

Estimated surplus or deficiency in local supply of Portland cement in cement-producing States, 1923 and 1924, in barrels

State or division	1923			1924		
	Shipments from mills	Estimated consumption	Surplus or deficiency	Shipments from mills	Estimated consumption	Surplus or deficiency
Alabama	3, 395, 392	1, 489, 531	+1, 905, 861	5, 542, 687	1, 872, 997	+3, 669, 690
California	10, 882, 802	10, 373, 163	+509, 639	11, 481, 730	10, 846, 703	+635, 027
Illinois	7, 129, 208	12, 237, 478	−5, 108, 270	6, 955, 455	13, 328, 219	−6, 372, 764
Iowa	5, 570, 675	3, 624, 857	+1, 945, 818	4, 881, 613	3, 144, 001	+1, 737, 612
Kansas	5. 878, 839	2, 613, 070	+3, 265, 769	5, 809, 646	2, 142, 725	+3, 666, 921
Michigan	7, 466, 283	7, 531, 664	−65, 381	8, 991, 270	9, 355, 024	−363, 754
Missouri	7, 143, 883	3, 492, 453	+3, 651, 430	7, 711, 206	3, 985, 049	+3, 726, 157
New York	6, 853, 062	15, 881, 436	−9, 028, 374	7, 435, 875	17, 456, 377	−10, 020, 502
Ohio	4, 003, 321	8, 843, 641	−4, 840, 320	4, 298, 027	9, 262, 652	−4, 964, 625
Pennsylvania	38, 610, 852	11, 281, 290	+27, 329, 562	40, 208, 860	12, 964, 163	+27, 244, 697
Texas	4, 091, 284	3, 328, 619	+762, 665	4, 488, 143	3, 853, 698	+634, 445
Colorado and Utah	2, 340, 386	1, 583, 106	+757, 280	2, 377, 774	1, 765, 291	+612, 483
Oregon, Washington, and Montana	3, 058, 018	3, 163, 021	−105, 003	2, 965, 918	3, 144, 727	−178, 809
Georgia, Kentucky, Tennessee, and Virginia	4, 928, 522	6, 000, 679	−1, 072, 157	6, 551, 628	6, 431, 877	+119, 751
Indiana, Wisconsin,[a] Minnesota, Nebraska, and Oklahoma	17, 828, 421	12, 042, 857	+5, 785, 564	18, 836, 592	16, 997, 027	+1, 839, 565
Maryland, New Jersey, and West Virginia	6, 731, 170	9, 045, 499	−2, 314, 329	7, 511, 125	10, 060, 261	−2, 549, 136
	135, 912, 118	112, 532, 364	+23, 379, 754	146, 047, 549	126, 610, 791	+19, 436, 758

[a] Wisconsin began producing and shipping in June, 1924.

The following table, which shows the shipments each month from Portland cement mills into States during 1924, has been compiled from monthly reports of producers but includes estimated distribution of shipments for three to five plants each month. Although the figures only approximate the totals shown in other tables of this report that are based on final annual reports from the producers, they reflect the fluctuations in shipments during the year.

Portland cement shipped from mills into States in 1924, by months, in barrels [a]

Shipped to—	January	February	March	April	May	June
Alabama	81, 010	141, 946	166, 154	162, 471	129, 432	115, 416
Alaska			132	231	637	132
Arizona	14, 185	27, 700	25, 659	30, 146	33, 469	31, 126
Arkansas	60, 791	54, 340	82, 059	105, 078	75, 258	89, 507
California	856, 997	757, 383	850, 536	899, 357	1, 044, 824	954, 751
Colorado	35, 905	65, 752	58, 747	111, 833	141, 894	140, 995
Connecticut	50, 230	38, 283	73, 917	143, 013	166, 717	181, 858
Delaware	8, 431	10, 088	15, 035	38, 393	42, 874	34, 413
District of Columbia	32, 480	43, 695	51, 768	55, 800	51, 807	60, 307
Florida	124, 981	154, 556	157, 704	140, 291	170, 110	148, 144
Georgia	80, 789	75, 087	104, 100	114, 026	117, 426	113, 412
Hawaii	8, 182	6, 947	2, 953	5, 478	1, 979	944
Idaho	16, 193	20, 885	16, 502	30, 538	28, 199	20, 583
Illinois	397, 878	547, 057	962, 510	1, 366, 987	1, 421, 534	1, 311, 151
Indiana	126, 203	214, 900	283, 594	454, 111	523, 774	556, 814
Iowa	51, 542	87, 144	146, 692	254, 796	421, 523	393, 866
Kansas	46, 443	88, 298	124, 379	248, 942	247, 164	194, 394
Kentucky	33, 644	51, 025	103, 672	156, 403	145, 624	157, 555
Louisiana	97, 861	91, 162	110, 922	140, 357	106, 977	100, 299
Maine	10, 447	10, 751	22, 975	34, 998	45, 512	49, 013
Maryland	53, 641	67, 471	131, 737	163, 161	157, 933	192, 865
Massachusetts	106, 833	98, 888	188, 117	309, 111	364, 354	372, 620
Michigan	203, 148	229, 929	424, 546	655, 933	989, 217	1, 133, 346
Minnesota	61, 434	141, 008	212, 160	240, 635	404, 999	451, 614
Mississippi	25, 907	29, 194	28, 800	41, 698	48, 772	38, 886
Missouri	75, 714	134, 634	201, 370	392, 769	391, 946	290, 852
Montana	4, 261	6, 443	10, 033	23, 446	28, 421	22, 106
Nebraska	47, 874	49, 306	78, 210	153, 517	154, 977	132, 394
Nevada	1, 335	4, 251	6, 258	7, 625	8, 480	11, 463
New Hampshire	11, 482	15, 734	27, 155	35, 556	37, 609	39, 026
New Jersey	229, 051	194, 146	373, 059	537, 307	593, 922	682, 058
New Mexico	7, 796	16, 129	16, 007	24, 154	37, 588	27, 893
New York	562, 858	518, 381	1, 043, 786	1, 558, 728	1, 710, 784	1, 986, 895
North Carolina	86, 661	120, 775	161, 171	232, 887	319, 454	278, 936
North Dakota	1, 958	3, 277	15, 741	25, 531	29, 414	45, 337
Ohio	249, 298	317, 151	501, 408	752, 723	863, 045	958, 245
Oklahoma	97, 193	147, 337	162, 654	269, 777	264, 611	189, 119
Oregon	33, 227	63, 985	90, 932	120, 593	113, 812	122, 893
Pennsylvania	389, 298	387, 651	641, 390	954, 720	1, 093, 389	1, 298, 303
Porto Rico						5, 186
Rhode Island	18, 385	17, 657	30, 219	56, 400	73, 437	73, 286
South Carolina	38, 077	43, 033	49, 767	49, 837	51, 285	47, 118
South Dakota	5, 610	18, 052	36, 289	37, 602	49, 995	54, 540
Tennessee	63, 721	69, 912	104, 162	147, 706	155, 684	129, 124
Texas	237, 761	231, 256	295, 361	389, 892	359, 570	344, 403
Utah	8, 378	20, 603	30, 921	45, 073	62, 439	53, 956
Vermont	21, 778	10, 833	13, 614	23, 082	28, 991	72, 169
Virginia	85, 440	78, 029	141, 142	179, 862	156, 109	118, 672
Washington	102, 917	81, 153	153, 249	167, 640	192, 570	275, 028
West Virginia	49, 066	54, 328	72, 567	147, 927	149, 396	215, 505
Wisconsin	58, 334	136, 899	239, 493	377, 659	474, 104	524, 846
Wyoming	6, 881	11, 266	13, 079	22, 017	40, 153	46, 734
Unspecified	54, 183	51, 524	55, 950	69, 520	139, 036	67, 442
	5, 133, 692	5, 857, 234	8, 910, 357	12, 707, 337	14, 462, 230	14, 957, 540
Foreign countries	76, 308	75, 766	84, 643	63, 663	88, 770	78, 460
Total shipped from cement plants	5, 210, 000	5, 933, 000	8, 995, 000	12, 771, 000	14, 551, 000	15, 036, 000

[a] Includes estimated distribution from three plants for January to June, and for October to December; from four plants for August and September; and from five plants for July.

Portland cement shipped from mills into States in 1924, by months, in barrels—Continued

Shipped to—	July	August	September	October	November	December
Alabama	212, 720	185, 494	167, 959	197, 661	189, 796	121, 826
Alaska	1, 432	1, 053	1, 846	437	231	173
Arizona	30, 474	32, 615	39, 176	44, 385	43, 541	37, 459
Arkansas	129, 334	139, 515	114, 134	119, 926	87, 735	41, 627
California	942, 273	960, 221	936, 834	983, 747	847, 790	738, 110
Colorado	161, 005	174, 924	150, 865	164, 675	89, 116	38, 782
Connecticut	192, 957	179, 012	193, 380	182, 135	114, 986	59, 533
Delaware	46, 078	49, 501	52, 272	47, 713	31, 546	7, 884
District of Columbia	79, 851	80, 080	79, 399	78, 597	62, 633	41, 729
Florida	173, 184	198, 827	220, 021	184, 982	220, 005	263, 031
Georgia	107, 824	134, 819	151, 930	137, 133	148, 597	121, 333
Hawaii	5, 451	1, 842	2, 076	2, 736	835	1, 164
Idaho	23, 922	28, 042	30, 221	29, 721	11, 300	6, 036
Illinois	1, 533, 330	1, 404, 542	1, 584, 579	1, 586, 058	865, 928	328, 101
Indiana	744, 692	781, 376	764, 188	653, 557	267, 367	121, 574
Iowa	401, 855	357, 329	461, 405	401, 177	129, 877	31, 141
Kansas	199, 437	228, 297	228, 064	288, 005	172, 934	62, 541
Kentucky	188, 068	203, 792	222, 361	253, 180	153, 650	58, 064
Louisiana	109, 385	104, 683	116, 770	112, 263	104, 021	61, 252
Maine	50, 045	48, 807	41, 945	42, 897	20, 649	8, 053
Maryland	218, 371	256, 498	230, 946	243, 639	180, 594	87, 137
Massachusetts	388, 173	369, 062	364, 320	385, 297	265, 416	140, 103
Michigan	1, 205, 309	1, 252, 561	1, 263, 113	1, 217, 809	582, 371	178, 516
Minnesota	405, 863	392, 542	397, 268	335, 139	136, 398	59, 101
Mississippi	41, 506	60, 512	59, 499	59, 230	39, 553	33, 644
Missouri	427, 101	435, 736	501, 596	593, 899	362, 170	121, 461
Montana	20, 985	26, 332	24, 935	19, 682	8, 974	6, 923
Nebraska	158, 955	178, 020	204, 610	226, 786	83, 880	28, 363
Nevada	8, 806	9, 847	12, 815	10, 010	7, 378	2, 681
New Hampshire	41, 240	46, 592	37, 872	42, 073	27, 402	16, 176
New Jersey	738, 895	712, 602	756, 579	774, 400	463, 036	290, 069
New Mexico	22, 007	24, 153	29, 306	13, 848	11, 492	6, 271
New York	2, 041, 145	1, 966, 885	1, 953, 647	1, 971, 186	1, 230, 384	737. 623
North Carolina	259, 730	383, 174	295, 252	326, 870	255, 535	126, 363
North Dakota	72, 154	33, 148	24, 990	15, 796	2, 876	132
Ohio	1, 211, 851	1, 164, 939	1, 059, 982	1, 255, 408	646, 386	221, 142
Oklahoma	177, 823	193, 464	185, 550	207, 750	187, 776	118, 645
Oregon	140, 656	153, 691	141, 492	112, 073	68, 474	43, 844
Pennsylvania	1, 580, 596	1, 737, 633	1, 672, 054	1, 813, 998	945, 003	436, 794
Porto Rico	------------	------------	------------	1, 000	500	------------
Rhode Island	60, 649	63, 326	70, 196	80, 138	44, 833	23, 818
South Carolina	42, 238	50, 890	52, 416	42, 076	57, 325	47, 310
South Dakota	70, 244	53, 360	60, 159	67, 413	15, 263	3, 627
Tennessee	148, 173	176, 909	196, 000	187, 410	140, 872	71, 319
Texas	388, 590	379, 845	308, 305	357, 878	314, 451	236, 875
Utah	55, 413	41, 539	47, 993	39, 420	17, 579	6, 316
Vermont	35, 469	46, 512	36, 842	30, 376	12, 923	4, 557
Virginia	156, 644	189, 686	184, 713	178, 013	144, 604	73, 039
Washington	179, 521	208, 254	175, 169	154, 515	91, 356	49, 976
West Virginia	226, 563	207, 811	191, 320	187, 214	114, 229	47, 324
Wisconsin	586, 677	551, 562	603, 204	556, 838	192, 256	55, 172
Wyoming	47, 769	46, 597	38, 828	32, 900	12, 484	9, 513
Unspecified	66, 488	73, 614	37, 101	45, 338	17, 199	7, 203
	16, 558, 921	16, 782, 067	16, 777, 497	17, 096, 407	10, 243, 419	5, 440, 450
Foreign countries	55, 079	72, 933	49, 503	63, 593	45, 581	65, 550
Total shipped from cement plants	16, 614, 000	16, 855, 000	16, 827, 000	17, 160, 000	10, 289, 000	5, 506, 000

PRICES

AT FACTORIES

Average values of Portland cement sold at the factories appear in the tables of shipments by States and districts during 1923 and 1924 (pp. 361 and 362). The averages by districts ranged from $1.69 in the Virginia-Tennessee-Alabama-Georgia district to $2.44 in the Oregon-Washington-Montana district in 1924, compared with a range from $1.76 in the Illinois-Indiana-Kentucky district to $2.44 in the Oregon-Washington-Montana district in 1923. The general average value for the whole country showed a decrease in 1924 of nearly 5 per cent and averages were lower in all the districts except Oregon-Washington-Montana, in which there was no change, and in all the States except Minnesota and Montana. In Washington and West Virginia the value remained the same.

For certain States the average factory value of Portland cement may be slightly higher than it would be if the ordinary structural cement were the only kind produced on account of the marketing of certain special cements that command a higher price. Among these are the white Portland cement made in Pennsylvania and also the cements particularly intended for shutting out water in oil wells and for stucco finish, both of which are made in California. Oil wells require a rapid-setting cement, and for stucco a cement that is more than ordinarily plastic and waterproof is desirable.

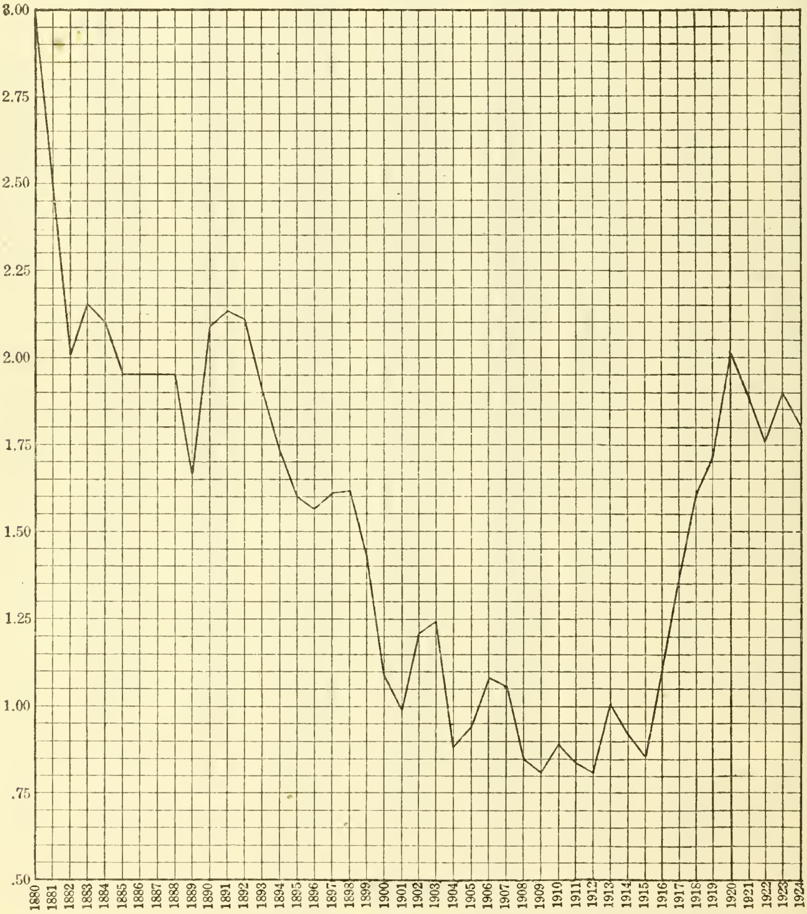

FIGURE 13.—Range in average factory value per barrel of Portland cement, 1880-1924

Average factory value per barrel in bulk of Portland cement, 1913-1924

1913	$1. 00	1917	$1. 35	1921	$1. 89
1914	. 93	1918	1. 60	1922	1. 76
1915	. 86	1919	1. 71	1923	1. 90
1916	1. 10	1920	2. 02	1924	1. 81

AT MARKETS

The accompanying table summarizes the wholesale prices of Portland cement in bulk in carload lots at the principal cities of the United States and at Montreal, Canada, for 1923 and 1924, by months, as they were published in the Engineering News-Record. As the footnotes indicate, this table is not absolutely consistent, and some of its inconsistencies, such as sudden large changes in prices, are not accounted for by the footnotes. The figures in this table may be compared in several different ways. Prices at a single locality for corresponding months of 1923 and 1924 and for the several months of the same year can readily be compared and also prices at different localities. As with factory values, the net result of the movement of market prices in 1924 was downward, the decreases ranging between 1 and 90 cents a barrel; in 1923 it was upward, the increases reaching 50 cents a barrel or more in places. At a few of the cities, as Chicago, Denver, Indianapolis, Philadelphia, and Seattle, the prices during several months in 1924 appeared to have remained the same as in 1923. In a number of cities prices for January and February were lower in 1924 than in 1923. By March, 1924, prices were lower at all cities that showed reductions except at Birmingham, Duluth, Minneapolis, Montreal, and St. Paul. From March up to August, three to five cities only show increases over the corresponding months in 1923, and from August through November lower prices seem to have been almost general. As might be expected, the lowest market prices were quoted at cities near which Portland cement is manufactured, such as Duluth, Chicago, Pittsburgh, St. Louis, and Dallas, but there are other cities where the proximity of cement mills might be expected to bring about lower prices than the table shows. In New York two scales of prices are quoted, the higher for cement delivered, the lower for cement alongside dock, the difference ranging from 10 to 45 cents a barrel, but this difference does not show any marked effect of foreign cement, nor do the prices at Los Angeles indicate the competition of imported cement.

The differences between average factory values for 1923 and 1924, by districts, and the market prices of cement at the principal cities within the several districts do not seem excessive in view of all the elements that enter into these differences. In 1923 the differences ranged from 9 cents to $1.41 a barrel and in 1924 from 20 cents to $1.18 a barrel. In most districts these differences were less than 75 cents a barrel in both years.

The increase in the prices of building materials and of all other commodities since the beginning of the World War has so seriously affected living conditions that many inquiries into the price situation have naturally followed, and efforts have been made to protect the public against organized price manipulation.

As the annual per capita consumption of Portland cement in the United States has reached nearly 1⅓ barrels and promises to continue to increase, the prices of such an essential building material have attracted particular interest, and considerable information is now available to show their position among those of other structural materials and to explain the economic conditions that determine them. Data of interest in this connection are compiled and published by the United States Bureau of Labor Statistics, Department of Labor.

Wholesale prices of Portland cement per barrel in bulk in carload lots, 1923 and 1924, by months [a]

City	January		February		March		April		May		June	
	1923	1924	1923	1924	1923	1924	1923	1924	1923	1924	1923	1924
Atlanta	$2.54	$2.35	$2.50	$2.35	$2.75	$2.35	$2.90	$2.35	$3.10	$2.35	$2.85	$2.35
Baltimore	------	2.50	2.51	2.50	2.61	2.50	2.61	2.50	3.05	2.50	2.65	2.50
Birmingham	2.40	2.80	2.40	2.80	2.40	2.80	2.50	2.65	2.50	2.65	2.50	2.65
Boston	2.85	2.63	2.75	2.63	2.75	2.63	2.75	2.65	2.80	2.63	2.80	2.65
Cedar Rapids	2.33	2.38	2.33	2.40	2.48	2.40	2.48	2.40	2.48	2.40	2.48	2.40
Chicago	2.05	2.10	2.05	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20
Cincinnati	2.39	2.41	2.39	2.37	2.54	2.37	2.54	2.47	2.54	2.47	2.54	2.49
Cleveland	2.36	2.41	2.36	2.41	2.46	2.39	2.46	2.39	2.46	2.39	2.46	2.39
Dallas	2.25	2.05	2.25	2.05	2.25	2.05	2.25	2.05	2.25	2.05	2.25	2.05
Davenport	2.28	2.29	2.28	2.29	2.43	2.29	2.43	2.39	2.43	2.39	2.43	2.39
Denver	2.85	2.84	2.85	2.84	2.85	2.84	2.85	2.84	2.85	2.84	2.84	2.84
Detroit	2.33	2.37	2.33	2.37	2.47	2.40	2.47	2.40	2.47	2.40	2.48	2.40
Duluth	2.04	2.19	2.04	2.19	2.14	2.19	2.14	2.19	2.14	2.19	2.14	2.19
Indianapolis	2.26	2.31	2.26	2.31	2.41	2.31	2.41	2.41	2.41	2.41	2.41	2.41
Jersey City	2.48	2.33	2.48	2.33	2.48	2.33	2.48	2.33	2.48	2.33	2.48	2.33
Kansas City	2.45	2.27	2.35	2.20	2.45	2.10	2.42	2.30	2.42	2.27	2.45	2.27
Los Angeles	------	3.16	------	3.16	------	3.00	3.40	3.00	3.40	3.00	3.20	3.00
Milwaukee	2.22	2.25	2.22	2.35	2.37	2.35	2.37	2.35	2.37	2.35	2.37	2.35
Minneapolis	2.29	2.42	2.29	2.42	2.39	2.42	2.39	2.42	2.39	2.42	2.39	2.42
Montreal	2.40	2.25	2.15	2.25	2.15	2.72	[b]2.88	2.72	[b]2.68	2.72	2.25	2.25
New Orleans	3.30	2.40	3.30	2.40	3.30	2.40	3.30	2.40	3.30	2.40	3.30	2.40
New York (delivered)	2.60 2.70	2.50 2.60	2.60 2.70	2.50 2.60	2.60 2.70	2.50 2.60	2.70 2.80	2.50 2.60	2.70 2.80	2.50 2.60	2.70 2.80	2.50 2.60
New York (alongside dock to dealers)	2.30	2.15	2.30	2.15	2.30	2.15	2.30	2.15	2.30	2.15	2.30	2.15
Peoria	2.26	2.27	2.26	2.27	2.41	2.27	2.41	2.37	2.41	2.37	2.41	2.37
Philadelphia	2.51	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41
Pittsburgh	2.14	2.19	2.14	2.19	2.24	2.19	2.24	2.19	2.24	2.19	2.24	2.19
St. Louis	2.35	2.20	2.35	2.20	2.35	2.20	2.35	2.20	2.35	2.30	2.35	2.30
St. Paul	2.29	2.42	2.29	2.42	2.39	2.42	2.39	2.42	2.39	2.42	2.39	2.42
San Francisco	2.71	2.61	2.71	2.61	2.71	2.61	2.71	2.61	2.71	2.61	2.71	2.61
Seattle	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
Toledo	2.33	2.38	2.33	2.40	2.48	2.40	2.48	2.40	2.48	2.45	2.48	2.45

City	July		August		September		October		November		December	
	1923	1924	1923	1924	1923	1924	1923	1924	1923	1924	1923	1924
Atlanta	$2.85	$2.35	$2.85	$2.35	$3.00	$2.35	$3.00	$2.35	$2.60	$2.35	$2.35	$2.35
Baltimore	2.65	2.50	2.65	2.50	2.65	2.90	2.65	2.90	2.65	2.90	2.61	2.90
Birmingham	2.70	2.65	2.70	2.40	2.70	2.40	2.70	2.40	2.80	2.40	2.80	2.40
Boston	2.80	2.63	2.90	2.64	2.90	2.64	2.78	2.70	2.90	2.70	2.92	2.67½
Cedar Rapids	2.48	2.44	2.48	2.44	2.48	2.44	2.48	2.44	2.48	2.44	2.38	2.44
Chicago	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.10	2.20
Cincinnati	2.54	2.47	2.54	2.47	2.54	2.47	2.54	2.47	2.54	2.47	2.41	2.47
Cleveland	2.46	2.39	2.46	2.39	2.46	2.39	2.46	2.39	2.46	2.39	2.41	2.39
Dallas	2.25	2.05	2.25	2.05	2.25	2.05	2.25	2.05	2.05	2.05	2.05	2.05
Davenport	2.43	2.39	2.43	2.39	2.43	2.39	2.43	2.39	2.43	2.39	2.29	2.39
Denver	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84
Detroit	2.48	2.40	2.48	2.40	2.48	2.40	2.48	2.40	2.48	2.40	2.37	2.40
Duluth	2.14	2.19	2.25	2.19	2.25	2.19	2.25	2.19	2.25	2.19	2.19	2.19
Indianapolis	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.31	2.41
Jersey City	2.48	2.33	2.48	2.33	2.48	2.33	2.48	2.33	2.48	2.33	2.33	2.33
Kansas City	2.45	2.27	2.55	2.82	2.90	2.70	2.45	2.70	------	2.42	2.27	2.07
Los Angeles	3.20	3.00	3.16	2.75	3.16	2.83	3.16	2.98	3.16	2.60	3.16	2.60
Milwaukee	2.37	2.35	2.37	2.35	2.37	2.35	2.37	2.35	2.37	2.35	2.25	2.35
Minneapolis	2.39	2.42	2.50	2.42	2.50	2.42	2.50	2.42	2.50	2.42	2.42	2.42
Montreal	2.25	1.90	2.25	1.90	2.25	1.90	2.25	1.80	2.25	1.80	2.25	1.80
New Orleans	3.30	2.40	3.30	2.40	2.90	2.40	2.90	2.40	2.90	2.80	2.80	2.80
New York (delivered)	2.70 2.80	2.50 2.60	2.70 2.80	2.50 2.60	2.70 2.80	2.50 2.60	2.70 2.80	2.50 2.60	2.70 2.80	2.50 2.60	2.55 2.65	2.50 2.60
New York (alongside dock to dealers)	2.30	2.15	2.30	2.15	2.30	2.15	2.30	2.15	2.30	2.15	2.15	2.15
Peoria	2.41	2.37	2.41	2.37	2.41	2.37	2.41	2.37	2.41	2.37	2.27	2.37
Philadelphia	------	2.41	------	2.41	2.75	2.41	2.96	2.41	2.96	2.41	2.81	2.41
Pittsburgh	2.24	2.19	2.24	2.19	2.24	2.19	2.24	2.19	2.24	2.19	2.19	2.19
St. Louis	2.35	2.30	2.35	2.30	2.45	2.30	2.45	2.30	2.45	2.30	2.35	2.30
St. Paul	2.39	2.42	2.50	2.42	2.50	2.42	2.50	2.42	2.50	2.42	2.42	2.42
San Francisco	2.71	2.61	2.63	2.61	2.63	2.61	2.63	2.61	2.61	2.61	2.61	2.61
Seattle	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.65	2.90	2.65
Toledo	2.48	2.45	2.48	2.45	2.48	2.45	2.48	2.45	2.48	2.45	2.38	2.45

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[a] Engineering News-Record. Prices quoted are f. o. b. points listed, without bags; cash discount not deducted.

[b] Delivered.

Comparative prices of building materials in December, 1923 and 1924 [a]

[Percentage of increase over prices in 1913]

	1923	1924
Building materials in general	78.3	75.1
Lime (lump), average, 15 plants	139.5	126.9
Plate glass, 3 to 5 feet, New York	132.4	81.7
Turpentine, New York	119.1	95.6
Brick, common, simple average at 82 brickyards	116.2	109.6
Linseed oil, New York	98.7	139.1
Douglas fir, No. 1, common, at mills	90.1	79.2
Yellow-pine flooring, B and better, at mills	83.2	92.8
Oak, plain white, No. 1, Cincinnati	75.6	72.4
Portland cement, simple average at 6 representative plants	74.9	75.4

[a] U. S. Department of Labor, Bureau of Labor Statistics, Wholesale Prices of Commodities, pp. 6–7, of reports for December, 1923 and 1924.

MANUFACTURING CONDITIONS

PLANTS

Portland cement was made at 132 plants in 1924 and at 126 in 1923. Six new plants produced Portland cement in 1924. These are all reported as wet-process plants and in addition are equipped (at the end of 1924) as follows:

Pacific Portland Cement Co., plant at Redwood City, San Mateo County, Calif. Oyster shells and clay; clinker burned with oil; two 9 to 10 by 230 foot kilns; reported daily clinker capacity, 3,000 barrels.

Ford Motor Co., plant at Dearborn, Wayne County, Mich. Limestone and slag; clinker burned with coal; one 10 by 150 foot kiln; reported daily clinker capacity, 1,200 barrels.

Pittsburgh Plate Glass Co., plant at Fultonham, Muskingum County, Ohio. Limestone and shale; clinker burned with coal; two 10 by 165 foot kilns; reported daily clinker capacity, 2,400 barrels.

South Dakota State Cement Plant, plant near Rapid City, Pennington County, S. Dak. Limestone and shale; clinker burned with coal; two 10 by 150 foot kilns; reported daily clinker capacity, 2,000 barrels.

Hermitage Portland Cement Co., plant at Nashville, Davidson County, Tenn. Limestone and clay; clinker burned with coal; two 10 by 150 foot kilns; reported daily clinker capacity, 2,000 barrels.

Manitowoc Portland Cement Co., plant at Manitowoc, Manitowoc County, Wis. Limestone and clay; clinker burned with coal; three 10 by 160 foot kilns; reported daily clinker capacity, 3,300 barrels.

At the end of 1924 additional plants were under construction in California, Georgia, Michigan, Ohio, Texas, and Virginia.

KILNS AND FUELS

The total number of rotary kilns reported in plants that were active in 1924 was 818, compared with 793 in 1923. Recent studies by engineers have indicated that the diameter as well as the length of rotary kilns should be considered. Some mills have increased the diameter of the lower end of the kiln, in the belief that this would increase the output of clinker.

As to kiln fuels, the records show that 79.7 per cent of the Portland cement produced was burned with coal alone in 1924 and 78.7 per cent in 1923; 11.1 per cent of the production was burned with crude oil in 1924 and 11.9 per cent in 1923.

Portland cement burned by different fuels, 1923 and 1924

Fuel	1923				1924			
	Number of plants	Number of kilns	Barrels of cement	Percentage of total	Number of plants	Number of kilns	Barrels of cement	Percentage of total
Coal	101	641	108, 272, 858	78. 7	106	661	118, 971, 392	79. 7
Coal and crude oil	1	24	8, 091, 506	5. 9	2	25	10, 326, 612	6. 9
Coal and natural gas					1	6		
Crude oil and natural gas	2	9			3	12		
Crude oil	18	95	16, 313, 410	11. 9	17	95	16, 601, 551	11. 1
Crude oil, coal, and natural gas	3	18	4, 782, 464	3. 5	2	12	3, 458, 554	2. 3
Natural gas	1	6			1	7		
	126	793	137, 460, 238	100. 0	132	818	149, 358, 109	100. 0

CAPACITY

The total annual manufacturing capacity of all the active plants at the end of 1924, according to manufacturers' reports (a few of which have been revised slightly for the sake of consistency) and a few estimates, was 175,100,000 barrels, an increase of 8 per cent. This total includes the annual capacity—about 4,645,000 barrels of finished Portland cement—of the six new plants completed during the year. According to these figures the total production of Portland cement in 1924 was 85.3 per cent of the total capacity, whereas the production in 1923 represented 84.9 per cent of the apparent total capacity in that year. It is difficult to determine the true cement-manufacturing capacity of the country. Some manufacturers report varying capacity totals from year to year, although their reports indicate no change of equipment. For 1924 reports from nine plants gave a capacity less than their production for the year, but due allowance was made for this oversight in the present estimates. The record production for one month during 1924 was reached in August, when 15,128,000 barrels was made, a daily average of 488,000 barrels, or 2 per cent more than the average daily capacity based on the annual capacity stated above. At this rate 178,120,000 barrels would be produced in a year, but in all probability the mills of the country could not sustain quite so great a productivity for a full year, even under the most favorable operating conditions and liveliest demand for cement, and therefore the capacity stated above for 1924 may be fairly accurate.

Portland cement manufacturing capacity of the United States, by commercial districts, 1923 and 1924

District	Estimated capacity (barrels)		Percentage of capacity utilized	
	1923	1924	1923	1924
Eastern Pennsylvania, New Jersey, and Maryland	42, 195, 000	43, 831, 000	84. 7	88. 2
New York	8, 306, 000	9, 107, 000	84. 2	83. 1
Ohio, western Pennsylvania, and West Virginia	15, 090, 000	16, 289, 000	89. 4	88. 0
Michigan	9, 346, 000	11, 501, 000	81. 5	80. 5
Wisconsin,[a] Illinois, Indiana, and Kentucky	22, 296, 000	23, 532, 000	95. 1	92. 7
Virginia, Tennessee, Alabama, and Georgia	10, 719, 000	12, 889, 000	73. 8	88. 5
Eastern Missouri, Iowa, Minnesota, and South Dakota [a]	16, 580, 000	17, 675, 000	84. 7	83. 9
Western Missouri, Nebraska, Kansas, and Oklahoma	11, 795, 000	12, 202, 000	82. 9	81. 1
Texas	4, 642, 000	5, 175, 000	90. 0	88. 2
Colorado and Utah	3, 025, 000	3, 205, 000	80. 3	75. 6
California	12, 594, 000	14, 727, 000	87. 4	78. 9
Oregon, Washington, and Montana	5, 270, 000	4, 967, 000	58. 9	60. 1
	161, 858, 000	175, 100, 000	84. 9	85. 3

[a] Wisconsin and South Dakota first included in 1924.

ALUMINA AND OTHER SPECIAL CEMENTS

The following titles represent a few of the papers that have appeared on these subjects since the Mineral Resources chapter on Cement in 1923 was issued:

Bertet, J., Influence of water content on heating of aluminous cements during hardening: Concrete, September, 1924, pp. 92–95.

Cement, Mill, and Quarry, Methods of alumina cement manufacture: May 5, 1925, pp. 25–26.

Chemical and Metallurgical Engineering, Progress in ciment fondu in France: May, 1925, p. 494. Gives various names—ciment noir, ciment fondu, cement electrique, electro-ciment, ciment electro-fondu, the term "ciment fondu" being that generally employed. Gives analyses of Portland and ciment fondu.

Concrete, American alumina cement: February, 1925, pp. 71–73. Summary of observations and conclusions based chiefly on the test and use of the American product. Written as a tentative statement only.

——— Manufacture of alumina cement in Europe: Mill Sec., May, 1925, pp. 59–60.

——— New Titan cement patented by Eckel: Mill Sec., November, 1924, p. 91. Describes materials from which the new product is made and the fundamental principles of manufacture.

——— Rapid hardening Portland cement: April, 1925, pp. 130–131.

Eckel, E. C., Fused Portland cement and other high-strength Portlands: Cement, Mill, and Quarry, August 20, 1924, pp. 27–29.

——— Titan and alumina cements: Canadian Min. Jour., November 21, 1924, pp. 1151–1152.

——— Titan and alumina cements—Their raw materials: Manufacturers Rec., October 9, 1924, pp. 79–80.

——— Titan and other high-strength cements—Materials and costs: Cement, Mill, and Quarry, November 20, 1924, pp. 14–16. Cement is made by smelting titaniferous or high-aluminous iron ores. Electric furnace used.

——— Titan cement and its raw materials: Cement, Mill, and Quarry, October 20, 1924, pp. 19–21.

Meyers, S. L., The set of lumnite cement: Concrete, March, 1925, pp. 85–87.

Mining Journal, Rapid-hardening cement in mines: May 16, 1925, p. 398.

Morrison, R. L., The properties and use of aluminate cement: Concrete, April, 1925, pp. 128–130.

Paris, A., Aluminous cement (ciment fondu) pure or mixed (sand cement): Concrete, August, 1924, pp. 69–71. From a paper presented at the International Cement Congress, London, April 22 and 23, 1924.

Prevost, Pierre, Rapid-hardening slag cement: Concrete, May, 1925, pp. 172–174. Discusses raw materials, composition, duration of setting, resistances to compression, uses of rapid-hardening slag cement, consolidation of the road macadam, manufacture and net price of rapid-hardening slag cement.

Rock Products, New process of making high alumina cement: May 30, 1925, p. 62. E. C. Eckel has patented a process for making high-alumina cement designed to overcome difficulties of present manufacturing process. Process is that of smelting iron ore with addition of large amount of such a slag-forming material that slag formed will be a fused, high-alumina cement.

Wolfram, Theodore, Cement fondu industry in France: Concrete, Mill Sec., May, 1925, p. 60.

MASONRY, NATURAL, AND PUZZOLAN CEMENTS

The term "masonry cement" is used here to designate certain cements made, like natural cements, by grinding calcined calcareous rock, that are being used largely in mortar for laying brick and stone, although, of course, other hydraulic cements are also suitable for masonry.

Natural cement, including masonry cement, was produced in 1924 in nine plants, distributed in eight States—near Rosendale, N. Y.; Siegfried, Pa.; Lisbon, Ohio; Speeds, Ind.; Utica, Ill.; Fort Scott, Kans.; Kosmosdale, Ky.; and Austin and Mankato, Minn.

One manufacturer with a plant at Birmingham, Ala., reports an output of puzzolan or slag-lime cement, and in order that this quantity may be included in the cement totals for the United States without revealing confidential information it is included with the statistics of masonry and natural cements.

The next table, which gives such statistics as may be presented concerning the output of masonry, natural, and puzzolan cements in 1923 and 1924, indicates an increase in quantity of 11.5 per cent and in value of 3 per cent as compared with the output in 1923. The average factory value per barrel in 1924 was $1.41, compared with $1.53 in 1923. The output has been expressed in terms of 376-pound barrels, to correspond with the statistics for Portland cement.

The second table presents quoted wholesale prices of these cements in lots of 500 barrels or more, exclusive of bags, f. o. b. at a number of widely separated cities in the United States, as published by the Engineering News-Record, but in order to make a consistent comparison of these prices the reader should note that barrels of 240, 250, 265, 300, and 380 pounds are involved instead of the standard Portland cement barrel of 376 pounds. These cements are packed four sacks to the barrel, each sack holding about 1 cubic foot, as with Portland cement, but the lower specific gravity of the non-Portland cements accounts for their lighter weight per barrel.

Masonry, natural, and puzzolan cement shipped from plants in the United States, 1923 and 1924

State	1923			1924		
	Producing plants	Barrels of 376 pounds	Value	Producing plants	Barrels of 376 pounds	Value
Alabama [a]	1	684, 563	$1, 137, 585	1	745, 369	$1, 147, 088
Illinois	1			1		
Indiana	1			1		
Kansas	1	587, 111	809, 767	1	673, 092	859, 471
Kentucky	1			1		
Minnesota	2			2		
New York	1			1		
Ohio	1			1		
Pennsylvania	1			1		
	10	1, 271, 674	1, 947, 352	10	1, 418, 461	2, 006, 559

[a] Puzzolan only.

Wholesale prices [a] of masonry, natural, and puzzolan cements, 1923 and 1924, by months

[Per barrel [b] except as otherwise noted]

City and brand	January		February		March		April	
	1923	1924	1923	1924	1923	1924	1923	1924
Atlanta (Magnolia) [c]	[c] $11. 00		[c] $11. 00		[c] $11. 00		[c] $11. 00	
Birmingham (Magnolia)		$2. 10		$2. 10		$2. 10		$2. 10
Boston (Rosendale)		2. 80	2. 65	2. 65	2. 60	2. 70	2. 60	2. 70
Cincinnati (Utica)	1. 72	1. 72	1. 72	1. 72	1. 72	1. 72	1. 72	1. 72
Kansas City (Fort Scott)	1. 50	1. 50	1. 50	1. 75	1. 50	1. 80	1. 50	1. 80
Minneapolis (Rosendale)	2. 80	2. 80	2. 80	2. 80	2. 80	2. 80	2. 80	2. 80
St. Louis (Carney)	1. 75	2. 25	1. 75	2. 45	1. 75	2. 45	1. 75	1. 95

[a] Engineering News-Record. Price to dealers per barrel for 500 barrels or more, f. o. b., exclusive of bags; unless otherwise designated.

[b] Available information indicates that the weights per barrel of these cements are as follows: Rosendale, 300 pounds; Utica, 265 pounds; Fort Scott, 240 pounds; Carney, 250 pounds; Magnolia (puzzolan cement), 380 pounds.

[c] Per ton.

Wholesale prices of masonry, natural, and puzzolan cements, 1923 and 1924, by months—Continued

City and brand	May		June		July		August	
	1923	1924	1923	1924	1923	1924	1923	1924
Atlanta (Magnolia)[c]	[c]$11.00	--------	[c]$11.00	--------	--------	--------	--------	--------
Birmingham (Magnolia)	--------	$2.10	--------	$2.10	$2.10	$2.10	$2.10	$2.10
Boston (Rosendale)	2.60	2.60	2.60	2.60	2.70	2.50	2.70	2.50
Cincinnati (Utica)	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72
Kansas City (Fort Scott)	1.50	1.80	1.50	1.80	1.50	1.80	1.50	1.50
Minneapolis (Rosendale)	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
St. Louis (Carney)	1.75	1.95	2.85	2.45	2.85	2.45	2.85	2.35

City and brand	September		October		November		December	
	1923	1924	1923	1924	1923	1924	1923	1924
Birmingham (Magnolia)	$2.10	$2.10	$2.10	$2.10	$2.10	$2.10	$2.10	$2.25
Boston (Rosendale)	2.80	2.50	2.80	2.50	2.80	2.50	2.80	2.50
Cincinnati (Utica)	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72
Kansas City (Fort Scott)	1.50	1.35	1.75	1.35	--------	1.50	1.50	1.50
Minneapolis (Rosendale)	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
St. Louis (Carney)	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35

[c] Per ton.

FOREIGN TRADE IN CEMENT[7]

EXPORTS

In 1924 the hydraulic cement exported to foreign countries and to the Philippine Islands, most of it Portland cement, decreased 12 per cent in quantity and 11 per cent in value as compared with 1923. The quantity exported in 1924 was about 0.6 per cent of the total shipments of hydraulic cement from mills in that year. The average value at the ports of export was $2.98 a barrel, as compared with $2.94 in 1923.

The destinations of the exports were approximately as follows: To Cuba, 330,000 barrels; other West Indies, 56,000 barrels; South America, 253,000 barrels; Mexico, 127,000 barrels; Central America, 72,000 barrels; Canada, 11,000 barrels; and other countries, 30,000 barrels. The export trade varies from year to year but has never reached large proportions. During recent years strong competition from manufacturers in Europe, where labor costs are much lower than in the United States, has restricted the foreign market for American cement.

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[7] Statistics of exports and imports were compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

Hydraulic cement exported from the United States, 1923 and 1924, by countries

Destination	1923		1924	
	Barrels	Value	Barrels	Value
North America:				
Canada	13,985	$67,224	11,380	$46,774
Central America—				
British Honduras	33	122	250	663
Costa Rica	3,486	10,576	5,518	19,188
Guatemala	6,948	20,686	4,295	12,967
Honduras	39,017	108,741	20,075	55,182
Nicaragua	4,168	14,107	4,673	17,260
Panama	23,028	59,653	29,238	77,325
Salvador	7,973	29,044	7,808	31,045
Mexico	101,478	333,061	126,712	398,802
Miquelon, Langley, and St. Pierre Islands	----------	----------	100	265
Newfoundland and Labrador	477	1,403	17	126
West Indies—				
British—				
Barbados	7	46	9	68
Bermuda	3,281	8,975	3,488	9,695
Jamaica	2,209	5,559	65	316
Trinidad and Tobago	1,711	4,826	191	1,288
Other British	24,942	65,018	11,884	30,327
Cuba	442,897	1,119,497	330,356	820,998
Dominican Republic	35,042	87,648	24,463	65,732
Dutch	1,394	3,971	583	1,568
French	----------	----------	333	885
Haiti	10,876	26,048	14,179	32,992
Virgin Islands of the United States	141	444	370	1,005
South America:				
Argentina	36,365	214,367	23,837	133,752
Bolivia	4,115	10,712	2,827	6,897
Brazil	6,402	37,330	10,795	61,363
Chile	6,868	27,468	6,388	27,889
Colombia	79,710	203,431	58,867	152,408
Ecuador	14,413	38,562	6,630	19,298
Falkland Islands	----------	----------	85	340
Guiana—				
British	45	329	59	411
Dutch	500	1,265	210	619
French	990	2,637	100	874
Peru	70,949	178,469	54,736	142,073
Uruguay	9,220	56,317	7,055	41,068
Venezuela	27,364	79,322	81,309	222,445
Europe:				
Azores and Madeira Islands	10	80	25	174
Belgium	60	748	57	575
France	202	1,430	----------	----------
Germany	12	91	250	1,567
Greece	75	561	185	1,120
Italy	10	73	3	29
Lithuania	2,000	5,190	----------	----------
Netherlands	110	732	93	747
Norway	103	671	159	1,077
Portugal	2	19	6	53
Spain	1,322	7,335	2,242	13,768
Switzerland	----------	----------	5	41
United Kingdom—				
England	8,824	56,372	14,262	83,775
Ireland	25	185	95	387
Scotland	475	3,157	1,155	9,121
Asia:				
China	2,110	12,939	952	5,755
Chosen	----------	----------	11	115
East Indies—				
British—				
Ceylon	30	147	20	160
India	611	3,934	906	6,326
Straits Settlements	477	2,770	1,274	7,441
Other British	125	700	----------	----------
Dutch—				
Java and Madura	715	4,576	1,024	6,158
Other Dutch	225	608	14	128
Hongkong	230	1,561	593	4,123
Japan	388	2,440	327	2,583
Palestine and Syria	----------	----------	252	1,549
Philippine Islands	168	1,275	211	1,605
Siam	----------	----------	50	344
Other	----------	----------	10	44

Hydraulic cement exported from the United States, 1923 and 1924 by countries—Continued

Destination	1923		1924	
	Barrels	Value	Barrels	Value
Africa:				
British South	211	$1,489	197	$1,364
Canary Islands	15	107		
Egypt			11	68
Portuguese—				
East	39	455		
Other	123	419	171	925
Oceania:				
British—				
Australia	1,433	9,420	2,300	13,283
New Zealand	807	5,379	2,386	15,457
Other British	50	184	109	383
French	667	2,269	256	858
Other			47	143
	1,001,688	2,944,174	878,543	2,615,154

Domestic hydraulic cement shipped to Alaska, Hawaii, and Porto Rico, 1923 and 1924

	1923		1924	
	Barrels	Value	Barrels	Value
Alaska	10,131	$41,511	19,877	$74,053
Hawaii	178,882	544,148	53,520	153,126
Porto Rico	99,275	250,844	98,001	230,525
	288,288	836,503	171,398	457,704

Hydraulic cement exported from the United States, 1919–1924

Year	Barrels	Value	Percentage of total shipments from mills	Year	Barrels	Value	Percentage of total shipments from mills
1919	2,463,573	$7,513,389	2.9	1922	1,127,845	$3,206,201	1.0
1920	2,985,807	10,045,369	3.1	1923	1,001,688	2,944,174	.7
1921	1,181,014	4,276,986	1.2	1924	878,543	2,615,154	.6

IMPORTS

In the accompanying tables of imports the quantities given include hydraulic cement of all kinds. Some of the cement imported evidently was not manufactured in the country from which it came to the United States.

The imports of hydraulic cement into the United States in 1924, which were more than 2,010,000 barrels, exceeded the imports for every other year since 1907, and showed an increase of nearly 20 per cent over 1923. The imports were received approximately as follows: From Belgium, 1,021,000 barrels; Norway, 532,000 barrels; Denmark, 346,000 barrels; Canada, 43,000 barrels; England, 29,000 barrels; Sweden, 15,000 barrels; Germany, 12,000 barrels; and other countries, 12,000 barrels. The districts into which more than 100,000 barrels were imported in 1924 are, in order, Los Angeles, Porto Rico, Hawaii, Philadelphia, Washington (State), Florida, and San Francisco. The average of the values assigned to the imports, which are supposed to represent the market values in the foreign countries from which the material is exported, including the cost of containers or coverings, was $1.55 a barrel in 1924, compared with $1.77 in 1923.

The tariff act of 1922 put hydraulic cements on the free list, with the proviso that if any country imposes a duty on such cement coming from the United States an equal duty shall be imposed upon such cement coming into the United States from that country.

Roman, Portland, and other hydraulic cements imported into the United States, 1923 and 1924, by countries

[General imports]

Country	1923		1924	
	Barrels	Value	Barrels	Value
Belgium	200,718	$295,518	1,021,213	$1,581,662
Canada:				
British Columbia and Yukon	9,812	32,739	42,953	71,091
Maritime Provinces	1,311	2,522		
Prairie Provinces	453	1,002		
Quebec and Ontario	217,018	392,563		
China	----------	----------	(a)	2
Denmark	370,410	573,701	346,354	488,633
England	186,152	430,470	28,852	44,031
France	1,703	2,775	5,451	8,503
Germany	47,344	75,966	11,957	17,814
Italy	(a)	10	6	11
Japan	48	165	810	1,723
Kwantung, Japanese leased territory	----------	----------	602	837
Mexico	(a)	2	----------	----------
Netherlands	1,996	3,432	(a)	3
Norway	420,233	752,047	532,089	858,073
Philippine Islands	(a)	3	5,010	12,105
Spain	----------	----------	6	10
Sweden	211,555	386,606	15,466	31,794
Switzerland	----------	----------	12	57
Turkey in Europe	95	255	----------	----------
Virgin Islands of the United States	9,788	14,322	155	215
	1,678,636	2,964,098	2,010,936	3,116,564

[a] Not recorded.

Roman, Portland, and other hydraulic cements imported into the United States, 1923 and 1924, by districts

[General imports]

District	1923		1924	
	Barrels	Value	Barrels	Value
Buffalo	66,790	$117,984	6,458	$10,424
Chicago	----------	----------	(a)	18
Connecticut	(a)	7	----------	----------
Dakota	453	1,002	----------	----------
Florida	103,759	199,702	121,836	181,064
Galveston	3,754	5,659	12	22
Georgia	18,575	27,905	----------	----------
Hawaii	72,323	136,256	226,556	353,133
Los Angeles	408,198	715,649	613,605	1,024,136
Maine and New Hampshire	3,205	7,236	3,324	4,829
Maryland	2,502	3,560	----------	----------
Massachusetts	6,202	9,629	58,198	87,781
Michigan	155	540	----------	----------
Minnesota	(a)	4	----------	----------
New Orleans	92,670	154,416	93,294	167,082
New York	63,359	101,296	75,064	106,159

[a] Not recorded.

Roman, Portland, and other hydraulic cements imported into the United States, 1923 and 1924, by districts—Continued

District	1923		1924	
	Barrels	Value	Barrels	Value
North Carolina	168,595	$381,788		
Oregon	111,511	185,489	34,094	$77,606
Philadelphia			167,654	178,099
Porto Rico	248,729	374,234	333,230	462,241
Rochester	5,618	10,507	2,580	3,252
San Francisco	102,786	161,883	106,865	179,738
South Carolina	36,185	53,302	10,580	15,414
St. Lawrence	44,329	82,238	3,837	6,392
Vermont	91,763	167,297	27,237	42,152
Virginia	5,615	9,442	(a)	3
Washington	21,560	57,073	126,512	217,019
	1,678,636	2,964,098	2,010,936	3,116,564

[a] Not recorded.

Roman, Portland, and other hydraulic cements imported into the United States in 1924, by countries and districts

[General imports]

Country and district	Barrels	Value
Belgium:		
Florida	44,663	$63,097
Galveston	6	7
Hawaii	35,746	50,048
Los Angeles	505,090	859,841
Maine and New Hampshire	2,949	3,996
Massachusetts	54,873	82,408
New Orleans	3,009	3,900
New York	65,967	90,084
Oregon	16,193	35,991
Philadelphia	161,006	168,875
Porto Rico	16,144	18,028
San Francisco	67,200	117,017
South Carolina	3,002	3,900
Washington	45,365	84,470
	1,021,213	1,581,662
Canada:		
Buffalo	6,458	10,424
Maine and New Hampshire	375	833
Massachusetts	173	300
Rochester	2,580	3,252
St. Lawrence	3,837	6,392
Vermont	27,237	42,152
Washington	2,293	7,738
	42,953	71,091
China: San Francisco	(a)	2
Denmark:		
Hawaii	33,368	49,464
New York	77	811
Porto Rico	312,909	438,358
	346,354	488,633
England:		
Massachusetts	596	1,080
New Orleans	22,930	31,288
New York	78	161
Oregon	4,998	11,061
San Francisco	250	441
	28,852	44,031
France:		
Chicago	(a)	14
Massachusetts	(a)	3
New Orleans	6	17
New York	4,790	6,965
San Francisco	655	1,504
	5,451	8,503
Germany:		
Chicago	(a)	4
New Orleans	11,242	16,677
Germany—Continued.		
New York	661	$1,013
San Francisco	54	120
	11,957	17,814
Italy: New York	6	11
Japan:		
Hawaii	745	1,427
San Francisco	65	296
	810	1,723
Kwantung, Japanese leased territory: San Francisco	602	837
Netherlands: Virginia	(a)	3
Norway:		
Florida	77,173	117,967
Galveston	6	15
Hawaii	155,506	249,214
Los Angeles	100,222	152,046
Massachusetts	2,556	3,990
New Orleans	56,101	115,190
New York	3,354	5,588
Oregon	11,670	21,096
Philadelphia	6,648	9,224
Porto Rico	4,022	5,640
San Francisco	31,479	45,885
South Carolina	7,578	11,514
Washington	75,774	120,704
	532,089	858,073
Philippine Islands:		
Hawaii	1,191	2,980
San Francisco	3,819	9,125
	5,010	12,105
Spain: New Orleans	6	10
Sweden:		
Los Angeles	8,293	12,249
New York	119	1,469
Oregon	1,233	9,458
San Francisco	2,741	4,511
Washington	3,080	4,107
	15,466	31,794
Switzerland: New York	12	57
Virgin Islands: Porto Rico	155	215
	2,010,936	3,116,564

[a] Not recorded.

Hydraulic cement imported for consumption in the United States, 1917–1924

Year	Barrels [a]	Value	Year	Barrels [a]	Value
1917	2,323	$6,076	1921	122,317	$388,842
1918	305	1,200	1922	355,931	692,429
1919	8,931	52,636	1923	1,767,264	3,145,977
1920	524,604	1,254,729	1924	2,023,663	3,139,788

[a] Barrels of 376 pounds in 1920 to 1924 and 380 pounds in earlier years.

CEMENT PRODUCTION IN CANADA

The total mill output of Portland cement in 1924 was 7,768,652 barrels. The shipments amounted to 7,498,624 barrels, valued at $13,398,411, compared with 7,543,589 barrels, valued at $15,064,661, in 1923. Thus there was a decrease of 44,965 barrels and of $1,666,250. The average selling price over the whole Dominion for 1924, computed from the total quantity sold and the total value as given, was $1.79 a barrel, as compared with $2 a barrel in 1923.

Summary statistics of the cement industry in Canada, 1923 and 1924 [a]

	1923		1924	
	Barrels	Value	Barrels	Value
Output	7,688,196		7,768,652	
Sold or used	7,543,589	$15,064,661	7,498,624	$13,398,411
Stocks Dec. 31	1,251,546		1,521,574	
Imports:				
Portland cement	17,697	75,294	27,672	69,320
Manufactures		86,974		9,772
Exports	493,751	824,811	153,520	213,845
Consumption	7,067,535		7,372,776	

[a] Dominion Bur. Statistics Ann. Rept., 1923, and Prel. Rept., 1925.

LITERATURE ON FOREIGN CEMENT INDUSTRY

American consumers and producers of Portland cement are showing more interest in the foreign cement situation. Presentation in this chapter of a table showing production of cement in the principal countries has been impracticable because of the inadequacy of official data. From time to time, however, trade and technical journals publish articles concerning individual plants or general features of the cement industry abroad. The following papers or notes may, therefore, be of interest to those who are seeking information of this sort:

BADDER, H. C., Cement industry in Great Britain: Concrete, Mill Sec., February, 1924, p. 30. There are 72 Portland cement works in Great Britain, 62 of which are in England. Capacity is about 4,000,000 tons of cement per year.

BIRD, M. C., The cement industry in South Africa: Concrete, Mill Sec., November, 1924, pp. 83–85. Gives details of plant.

CEMENT, MILL, AND QUARRY: September 20, 1924, p. 41. The Onoda cement factory, Choushuitzu, Japan, now supplying 700,000 barrels of cement a year has opened a business relation with Java through the Mitsui Bussan Kaisha, and many thousands of barrels of Onoda cement already have been shipped.

——— Bolstering up the Indian cement industry: December 5, 1924, p. 11.

——— Shanghai Portland cement works: July 5, 1924, pp. 28–30.

CONCRETE, Modern quality standards of Portland cement in England: Mill Sec., November, 1924, p. 94.

GOOSSENS, J., Cement plant of J. Van Den Heuvel: Concrete, Mill Sec., February, 1924, p. 21. Uses wet process. Mons chalk (lime) and the blue clay or marl come from sources close to factory.

PREVOST, P., Cements from blast furnace slags in France: Concrete, Mill Sec., March, 1925, pp. 40–42.

ROCK PRODUCTS, German cement industry in 1924: May 16, 1925, p. 60.

PETROLEUM

By G. B. Richardson and A. B. Coons[1]

SUMMARY

In 1924 the production of petroleum in the United States amounted to 713,940,000 barrels, which is 2.5 per cent less than that in 1923 and is the first annual decrease in production since 1906. The decline is chiefly due to the decrease of 13 per cent in the California output from the record high yield in 1923. Smaller declines are also recorded in all the other major fields excepting the Mid-Continent. In the Mid-Continent field, which produces more than half of the output of the entire country, an increase of almost 8 per cent over the 1923 output is recorded. California again led all other States in the production of petroleum with an output of 228,933,000 barrels. Oklahoma ranked second, with a production of 173,538,000 barrels, and Texas third, with 134,522,000 barrels. The output of these three States in 1924 was more than 75 per cent of the production of petroleum in the entire country. In 1924 the output of heavy oil, heavier than 24° A. P. I. (0.910), increased to 24 per cent of the total production of the United States; in 1923 it amounted to 18 per cent of the total.

The world's output of petroleum in 1924 passed, for the second year, the billion-barrel mark, but the output of 1,013,559,000 barrels was more than 2,000,000 barrels less than that in 1923. The decreased production in the United States and in Mexico, whose output was 10,000,000 barrels less than in 1923, was not entirely offset by considerable gains in Russia, Persia, Rumania, Venezuela, Peru, and Argentina, and by smaller gains in most of the other petroleum-producing countries. Venezuela, by producing 9,042,000 barrels in 1924, more than doubled its output of 1923, and progressed from tenth to seventh in rank among the petroleum-producing countries of the world.

Imports into the United States in 1924 of almost 78,000,000 barrels of crude oil, equal to 11 per cent of the domestic production, were 4,000,000 barrels less than in 1923 but contrast with imports of 127,000,000 barrels in 1922, which were equivalent to 23 per cent of the domestic production for that year. As in previous years, the great bulk of imports came from Mexico and the decreased quantity followed the decreased production of that country. Increasing quantities of petroleum were imported from Peru and Venezuela. Exports of crude oil, amounting to almost 18,000,000 barrels, increased slightly.

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[1] Unless otherwise indicated, the tables in this report have been prepared by A. B. Coons, M. N. Schellenger, A. L. Clapp, and C. M. Shanner, of the Bureau of Mines.

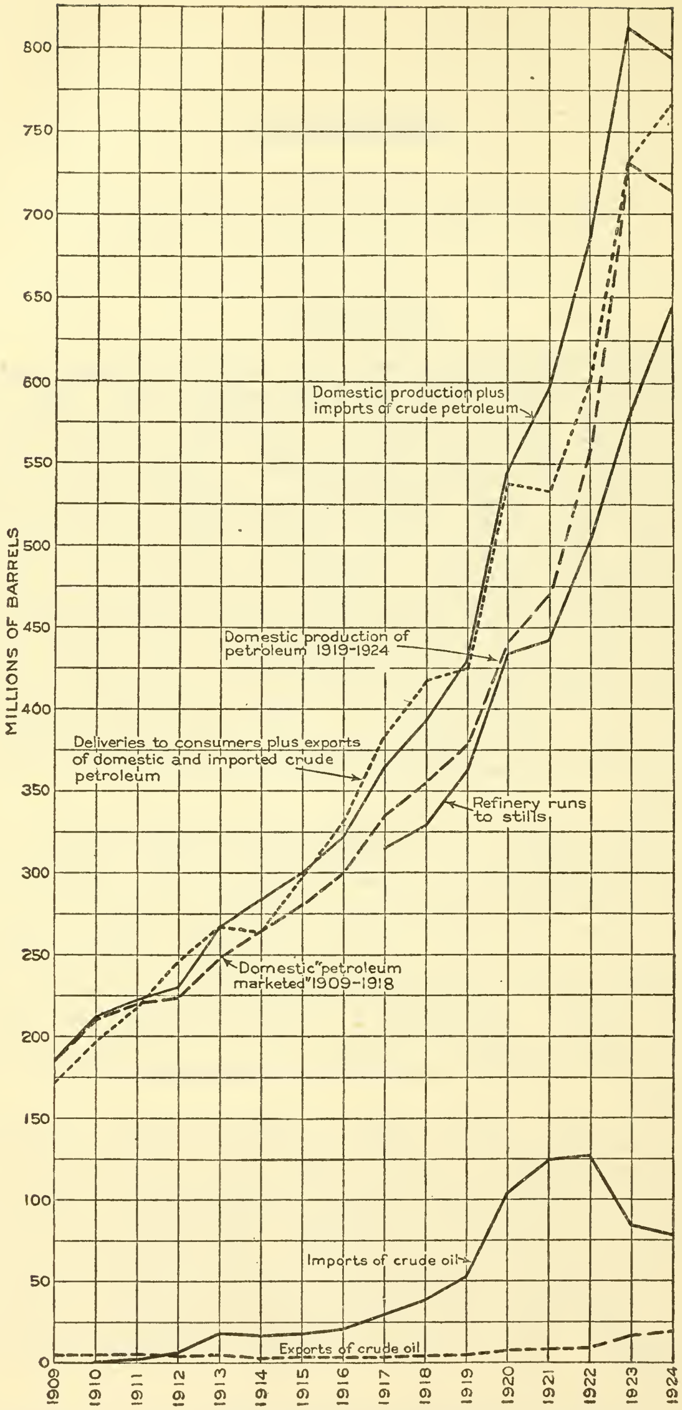

FIGURE 14.—Crude petroleum produced, imported, exported, delivered to consumers, and run to stills, 1909–1924

The demand for crude petroleum continued to grow in 1924, but at a lower rate contrasted with the increase in 1923 and 1922, and, as in the past few years, the demand was somewhat less than the new supply. The total indicated domestic consumption in 1924 was 748,462,000 barrels; 643,719,000 barrels of this was run to refinery stills and the remainder was consumed as fuel.

The excess of supply over the demand resulted in an increase of 25,280,000 barrels in stocks of crude petroleum. Total stocks including crude at refineries, on December 31, 1924, were 399,792,000 barrels. In addition 85,611,000 barrels of liquid refined products were held at refineries as contrasted with 77,455,000 barrels on the last day of 1923.

Continued low prices reflected this oversupply, which has been pronounced since 1920. The average price per barrel at the wells was $1.43 in 1924, as contrasted with $1.34 in 1923 and $3.07 in 1920. The total value at the wells of the Nation's crude petroleum output, $1,022,683,000, has been exceeded only once in the history of the industry, in 1920, when the total value of a much smaller output was $1,360,745,000.

During the year 21,888 wells were drilled for oil and gas in the United States; 14,587 were oil wells and the remainder gas wells or dry holes. On December 31, 1924, there were 299,100 producing oil wells in the United States and the average daily production per well was 6.2 barrels.

Condensed summary of statistics of crude petroleum, 1920–1924

	1920	1921	1922	1923	1924
Domestic production.....thousands of barrels [a]..	442,929	472,183	557,531	732,407	713,940
Imports.....do....	106,175	125,364	127,308	82,015	77,775
	549,104	597,547	684,839	814,422	791,715
Indicated domestic demand [b].....do....	530,532	526,032	592,432	714,862	748,462
Exports (including foreign crude oil).....do....	8,757	8,940	10,163	17,385	17,973
Added to stocks [c].....do....	9,815	62,575	82,244	82,175	25,280
	549,104	597,547	684,839	814,422	791,715
Runs to refinery stills.....do....	433,915	443,363	500,706	581,238	643,719
World's production.....do....	688,804	765,903	858,909	1,015,727	1,013,559
United States percentage of world's production..	64	62	65	72	70
Total value of domestic production at wells.....thousands of dollars..	1,360,745	814,745	895,111	978,430	1,022,683
Average price per barrel at wells.....	$3.07	$1.73	$1.61	$1.34	$1.43
Total number of producing oil wells, Dec. 31....	[d] 258,600	274,500	284,880	290,100	299,100
Total number of oil wells completed during year.	24,273	14,666	17,333	16,206	14,587

[a] 42 United States gallons.

[b] 1920–1922: Deliveries to domestic consumers; 1923–24: Domestic consumption.

[c] 1920–1922: Producers', pipe-line, and tank-farm stocks of domestic petroleum and stocks of foreign petroleum held in the United States by importers; 1923–24: Producers', pipe-line, tank-farm, and refinery stocks of domestic and foreign petroleum (topped oil topped in Mexico not included in 1924).

[d] Oct. 31.

Summary of statistics of crude petroleum, 1913–1924

Monthly averages by years, 1913-1924

	Production		Imports		Stocks at beginning of period[a]		Supply		Indicated domestic demand[b]		Exports		Indicated domestic demand plus exports		Wholesale price of all commodities[d] (index No.[c])	Price of Oklahoma-Kansas grade crude oil	
	Thousands of barrels	Index No.[c]	Thousands of barrels	Index No.[c]	Thousands of barrels	Index No.[c]	Thousands of barrels	Index No.[c]	Thousands of barrels	Index No.[c]	Thousands of barrels	Index No.[c]	Thousands of barrels	Index No.[c]		Dollars	Index No.[c]
1913	20,704	100	1,415	100	122,870	100	144,989	100	21,738	100	386	100	22,124	100	100	0.939	100
1914	22,147	107	1,409	100	122,803	100	146,359	101	21,747	100	248	64	21,995	99	98	.76	81
1915	23,425	113	1,512	107	141,550	115	166,487	115	24,231	111	314	81	24,545	111	101	.60	64
1916	25,064	121	1,733	122	194,185	158	220,982	152	27,035	124	341	88	27,376	124	127	1.26	134
1917	27,943	135	2,511	177	179,372	146	209,826	145	31,526	145	342	89	31,868	144	177	1.81	193
1918	29,661	143	3,145	222	159,452	130	192,258	133	34,356	158	408	106	34,764	157	194	2.20	234
1919	31,531	152	4,402	311	128,586	105	164,519	113	35,039	161	502	130	35,541	161	206	2.28	243
1920	36,911	178	8,848	625	136,213	111	181,972	126	44,211	203	730	189	44,941	203	226	3.42	364
1921	39,349	190	10,447	738	[e]146,028 [f]128,187	119 104	[e]195,824 [f]177,983	135 123	43,836	202	745	193	44,581	202	147	1.65	176
1922	46,461	224	10,609	750	190,762	155	247,832	171	49,369	227	847	219	50,216	227	149	1.67	178
1923	61,034	295	6,835	483	[g]273,006 295,708	222 241	[g]340,875 363,577	235 251	59,572	274	1,449	375	61,021	276	154	1.45	154
1924	59,495	287	6,481	458	377,883 [h]374,512	308 305	443,859 [h]440,488	306 304	62,372	287	1,498	388	63,870	289	150	1.47	157
By months, 1923-24																	
1923																	
January	52,527	254	7,307	516	295,708	241	355,542	245	58,120	267	762	197	58,882	266	156	1.38	147
February	48,588	235	6,199	438	296,660	241	351,447	242	53,293	245	666	173	53,959	244	157	1.76	187
March	56,969	275	8,058	569	297,488	242	362,515	250	56,676	261	1,028	266	57,704	261	159	1.85	197
April	59,008	285	6,617	468	304,811	248	370,436	255	58,530	269	1,511	391	60,041	271	159	1.82	194
May	62,377	301	5,995	424	310,395	253	378,767	261	57,643	265	1,324	343	58,967	267	156	1.50	160
June	62,845	304	5,996	424	319,800	260	388,641	268	54,938	253	2,598	673	57,536	260	153	1.45	154
July	65,925	318	6,915	489	331,105	269	403,945	279	60,194	277	1,547	401	61,741	279	151	1.45	154
August	66,422	321	7,580	536	342,204	279	416,206	287	63,918	294	1,542	399	65,460	296	150	1.45	154
September	65,306	315	6,021	426	350,746	285	422,073	291	63,742	293	1,592	412	65,334	295	154	1.39	148
October	67,506	326	6,825	482	356,739	290	431,070	297	62,684	288	1,315	341	63,999	289	153	1.30	138
November	65,388	316	6,085	430	367,071	299	438,544	302	61,517	283	1,397	362	62,914	284	152	1.07	114
December	59,546	288	8,417	595	375,630	306	443,593	306	63,607	293	2,103	545	65,710	297	151	1.00	106

1924																
January	57, 273	277	6, 303	445	377, 883 [h]374, 512	308 305	441, 459 438, 088	305 302	61, 145	281	1, 528	396	62, 673	283	151	1. 25	133
February	55, 889	270	6, 511	460	375, 415	306	437, 815	302	57, 361	264	1, 680	435	59, 041	267	152	1. 59	169
March	60, 141	290	8, 631	610	378, 774	308	447, 546	309	63, 841	294	1, 485	385	65, 326	295	150	1. 72	183
April	59, 830	289	7, 297	516	382, 220	311	449, 347	310	59, 802	275	1, 547	401	61, 349	277	148	1. 75	186
May	61, 834	299	7, 393	522	387, 998	316	457, 225	315	62, 234	286	1, 850	479	64, 084	290	147	1. 75	186
June	59, 583	288	6, 660	471	393, 141	320	459, 384	317	60, 803	280	1, 542	399	62, 345	282	145	1. 75	186
July	61, 932	299	6, 502	460	397, 039	323	465, 473	321	62, 720	289	1, 409	365	64, 129	290	147	1. 72	183
August	62, 398	301	5, 762	407	401, 344	327	469, 504	324	60, 465	278	1, 242	322	61, 707	299	150	1. 50	160
September	60, 376	292	5, 354	378	407, 797	332	473, 527	327	60, 168	277	1, 835	475	62, 003	280	149	1. 36	145
October	60, 469	292	4, 872	344	411, 524	335	476, 865	329	66, 412	306	1, 423	369	67, 835	307	152	1. 10	117
November	56, 782	274	6, 649	470	409, 030	333	472, 461	326	64, 558	297	1, 453	376	66, 011	298	153	1. 10	117
December	57, 433	277	5, 841	413	406, 450	331	469, 724	324	68, 953	317	979	254	69, 932	316	157	1. 10	117

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[a] Stocks 1913–1922, include producers', pipe-line, and tank-farm stocks of domestic petroleum, and since 1919 stocks of foreign petroleum held in the United States by importers; 1923–24, include also stocks of domestic and foreign petroleum at refineries.

[b] 1913–1922: Deliveries to domestic consumers; 1923–24: Domestic consumption.

[c] Index numbers based on monthly average for 1913=100.

[d] Department of Labor.

[e] Stocks as reported by unrevised method comparable with preceding years.

[f] Stocks as reported by revised method. (See Mineral Resources, 1921, pt. 2, p. 284, 1923.)

[g] Exclusive of stocks at refineries.

[h] Exclusive of stocks of foreign topped oil.

PRODUCTION

DOMESTIC PRODUCTION

RANK OF STATES

California, Oklahoma, and Texas, ranking in the order named, produced in 1924 more than 75 per cent of the total output of petroleum in the United States. The other States ranked as follows: Arkansas (which advanced from fifth to fourth place), Wyoming, Kansas, Louisiana, Illinois, Pennsylvania (which by a small margin over Kentucky advanced from tenth to ninth place and regained its position as the leading oil-producing State in the Appalachian field), Kentucky, Ohio, West Virginia, Montana, New York, Indiana, Colorado, New Mexico, Tennessee, Alaska, and Utah.

CALIFORNIA

In 1924, California retained first rank in the production of petroleum although its output, 228,933,000 barrels, was 33,943,000 barrels less than that in 1923, a decrease of 13 per cent. The production of the three large fields, Santa Fe Springs, Long Beach, and Huntington Beach, which yielded more than two-thirds of California's total output in 1923, fell 78,515,000 barrels below the 1923 yield. The production of the Long Beach pool, however, was maintained at a higher rate than that of the others and in December the field was making a daily average of 125,000 barrels. The Long Beach and the Midway-Sunset, which in December produced a daily average of 106,000 barrels, were the only California fields that are credited with an output of more than 100,000 barrels a day.

The largest gain over the preceding year was in the Torrance field, whose output increased 13,213,000 barrels. The Dominguez field also produced considerably more than in 1923. The output of a number of heavy-oil fields, where wells had been closed in during the period of excessive overproduction in 1923, increased during 1924; thus the output of the Midway-Sunset field increased more than 10,000,000 barrels and that of the Elk Hills, Coalinga, and Coyote fields also increased.

Two new fields in the Los Angeles Basin, Rosecrans and Inglewood, were discovered during 1924. The Rosecrans field is credited with an output of 534,503 barrels in 1924. The small output of the Inglewood field in 1924 (6,180 barrels) gave little indication that in 1925 the field would be one of the large producers in California.

The Inglewood field is situated in the Baldwin Hills in general alignment with the Rosecrans, Dominguez, Long Beach, and Huntington Beach fields. This area had long been considered a possible source of oil; in fact, between 1917 and 1924 a number of unsuccessful test wells were put down in the Baldwin Hills. Credit for the discovery of oil in this field belongs to the Standard Oil Co. (California). The discovery well, situated a short distance west of a fault, was completed as a commercial well on September 28, 1924. When the Mohawk No. 1 was successfully completed on December 31, 1924, at a depth of 2,304 feet, drilling in the field became more active. During the next four months 23 wells were completed, which had a production of 5,420 barrels, or 236 barrels a well. This low average was due to the fact that the wells were producing only from a part of the oil zone as later developed. The Associated Oil Co. in its Vickers No. 2 well, which was completed April 26, 1925, at a depth of 2,548 feet, first penetrated the full 1,250 feet of oil zone; by the 1st of May its production was 2,000 barrels a day. The peak of production for the field was thought to have been attained on July 29, 1925, when 116,098 barrels per day was produced from 120 wells.[2]

Drilling activities in California in 1924 [3] responded to increased prices, and 1,238 producing wells with an estimated daily average initial production of 411 barrels were completed. In 1923, 980 wells were completed, which had an average initial production of 1,404 barrels.

During 1924 shipments of California crude petroleum through the Panama Canal to eastern ports in the United States were 39,847,000 barrels, as contrasted with 52,983,000 barrels in 1923, but shipments of refined products of California oil through the canal to eastern ports in the United States increased from 459,000 long tons in 1923 to 680,000 tons in 1924,[4] foreshadowing the increased shipments of California refined products through the canal in 1925.

OKLAHOMA

Oklahoma's production of 173,538,000 barrels of petroleum marked an increase of 7.8 per cent over its previous record made in 1923. The larger yield was caused by flush production in the Cromwell, Papoose, and Stroud pools, by the output of the deep Wilcox sands in the Tonkawa pool, and by the sustained production of the older pools. Burbank, Tonkawa, and Cromwell furnished approximately 35 per cent of the total output. In January Oklahoma produced 12,109,000 barrels, and in each succeeding month the output increased until the peak for the year was reached in September, with 16,109,000 barrels; in December production declined to 15,273,000 barrels. The Burbank pool attained its peak in April, with an estimated daily average output of 122,000 barrels; the Cromwell pool in August, with 63,800 barrels, and the Tonkawa pool in September, with 111,950 barrels.

In 1924, 4,814 wells were completed, of which 3,038 were oil wells, 468 gas wells, and 1,308 (27 per cent) dry holes, the total making the smallest number drilled for oil and gas in any one year since 1915.

TEXAS

Texas produced 134,522,000 barrels of petroleum in 1924, an increase of 2.7 per cent over the 1923 output. The Gulf coast salt-dome pools continued to decline, but gains in the rest of the State more than made up the loss. Renewed interest, however, was taken in the Gulf coast field because of the geophysical methods, including the use of the seismograph and torsion balance, which were applied to the finding of salt domes. The discovery by these instruments of the Nash, Orchard, and Long Point salt domes in Fort Bend County was reported in 1924. The production from pools in east and south central Texas increased by more than 8,000,000 barrels. The oil of these pools, which include, among others, those along the Mexia and Balcones fault zone, is in rocks of Cretaceous age. The pools in north central Texas, where the oil is in rocks of Paleozoic age, decreased their output by 1,409,000 barrels. On the other hand, in West Texas, where the oil also is in rocks of Paleozoic age, the output increased by 1,600,000 barrels. This district comprises the Big Lake and Westbrook pools and those in Carson and Hutchinson Counties.

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[2] Joseph Jensen, The Inglewood oil field: Oil Bull., Sept., 1925, pp. 909-918.
[3] For details, see pp. 447-448.
[4] For monthly figures, see p. 421.

The following pools were discovered or developed in 1924: Big Lake, in Reagan County; Richland, in Navarro County; Wortham, in Limestone and Freestone Counties; Henne, Winch, and Fariss, in Jim Hogg County; and a number of small ones in Archer, Young, and Wilbarger Counties. Some of the older fields were extended, notably Luling, which was extended southward into Guadalupe County, and the producing areas in Carson and Hutchinson Counties in the Panhandle.

The Richland and Wortham pools were discovered after intensive drilling along the Mexia fault zone, but many dry holes were drilled in the attempt to find production in the possible northeast extension of the zone in Kaufman, Van Zandt, Rains, Hunt, and Hopkins Counties.

The Richland field is just east of Richland in Navarro County. The discovery well was completed about the beginning of the year, and had an initial production of 300 barrels a day from a sand at a depth of 2,960 to 2,977 feet. On December 1, the average daily production of 84 wells was 11,215 barrels. By December 31, 1924, some 3,436,000 barrels of petroleum had been produced. The oil has a gravity of about 38° (0.835). Production is from the upper part of the Woodbine formation where there are two pays separated by a hard break. The upper pay gave wells of 200 to 500 barrels initial yield, which had to be pumped, whereas the lower pay produced flowing wells having initial yields of 1,000 barrels or more. The pool covers about 250 acres.

The Wortham field, extending southwest through the eastern part of the town of Wortham in Freestone County, first came into prominence late in November, 1924, when the Boyd Oil Co. brought in its Boyd No. 1 and Simmons No. 1. The Boyd No. 1 well, near the southern end of the field, had an initial production of 2,000 barrels from a total depth of 3,012 feet. The Simmons No. 1, which is about 8,500 feet northeast of the Boyd No. 1, had an initial yield of more than 7,000 barrels from a depth of 2,962 feet. Within 10 days after these two wells came in, 60 derricks had been built. On January 1, 1925, there were 200 drilling wells and 60 producers and the daily production had risen to more than 150,000 barrels. The oil has a gravity of 38° or 39°. As at Richland there are two main pays, the lower one yielding the larger production; both are in the upper part of the Woodbine formation at the base of the Upper Cretaceous.[5]

ARKANSAS

Arkansas is credited with a production of 46,028,000 barrels in 1924, an increase of 26 per cent over the output of the preceding year. No new pools were discovered, and the gain in output came mainly from increased development of the Smackover pool; small gains are also reported for the Stephens and Irma pools. A decline of 1,070,000 barrels, almost 20 per cent, is reported for the El Dorado pool.

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[5] Lahee, Frederic H., Production of petroleum in 1924: Trans. Am. Inst. Min. and Met. Eng., 1925, pp. 131–138.

The output of the Smackover field for the year averaged more than 100,000 barrels a day. By December, 1924, the yield had declined materially and there was then no indication that within a few months production from a deeper sand would swell the total from the field to a daily average for an entire month of more than 400,000 barrels.

WYOMING

Wyoming recorded a decrease in production for the first time since the State became a large producer; its output of 39,498,000 barrels for 1924 is 11.8 per cent less than that for 1923. The decrease is due almost entirely to the decline in the Salt Creek pool, as gains and losses in the other pools of the State were nearly equal.

From its first systematic development in 1911 through 1924, the Salt Creek field has produced more than 138,000,000 barrels of petroleum with an estimated average gravity of 37° (0.840). This record puts the Salt Creek field among the important high-grade oil fields of the world. The peak production of this pool apparently was reached in January, 1924, when the daily average was 113,225 barrels. Production continued to decline throughout 1924 and for December the daily average output fell to 49,613. This rapid decline was due to falling gas pressure and to the shutting down of a number of wells to await the change from flowing to pumping and the completion of a large electric plant that will supply power for pumping and drilling. The completion of these facilities caused the production of the field to increase to more than 60,000 barrels a day during 1925.

There are three sands of first importance in the Salt Creek field—the First and Second Wall Creek and the Lakota. Two other sands, the Shannon and Third Wall Creek, have proved productive locally. The most important sand, which to date has yielded more than three-fourths of the production, is the Second Wall Creek, which ranges from 45 to 75 feet in thickness and is found at depths of 1,300 to 2,860 feet. The oil-bearing area of this sand covers about 20,000 acres, and within it there has scarcely been a dry hole drilled. A number of deeper sands, which in other Wyoming fields are oil-bearing, remain to be tested in the central part of the Salt Creek structure, where they can be reached at a depth of less than 4,400 feet. These are the Morrison, Sundance, Chugwater, Embar, Tensleep, and Amsden formations.[6]

The pipe line from the Salt Creek and Teapot fields across Nebraska and Kansas to the Sinclair pipe line in Missouri, a distance of more than 700 miles, was completed in the spring of 1924. The first oil through the line is reported to have reached Fremont, Mo., on April 17. The construction of this pipe line, allowing direct competition of Wyoming and Mid-Continent crude petroleum, resulted in putting prices of Wyoming crude oil on a level with prices of similar grades from the Mid-Continent field.

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[6] Fisher, C. A., Salt Creek oil field, Wyoming: Min. and Met., vol. 6, 1925, pp. 279–284.

KANSAS

In 1924 the production of petroleum in Kansas, which had been declining for several years, increased 2 per cent over the output in 1923 through the production of 28,836,000 barrels. This increase followed the discovery of several new pools.

Of the new developments the most important was the opening up of the Rainbow Bend pool, about 12 miles southwest of Winfield, in T. 33 S., R. 3 E., Cowley County. The oil comes from the Burbank sand, locally called the "Rainbow," found at a depth of 3,200 feet. The sand ranges in thickness from 25 to 40 feet in the 17 wells completed during the year and the initial productions ranged from 300 to 3,000 barrels a day. Development of the pool discovered late in 1923 in Russell County in sec. 8, T. 12 S., R. 15 W., continued and the reported production during 1924 was 275,000 barrels. The oil sand, found at a depth of 3,000 feet, has been correlated with the Oread horizon of Pennsylvanian age, occurring in the eastern part of Kansas. The initial production of the discovery well was about 175 barrels a day. At the end of the year 10 wells in this pool were producing 1,500 barrels a day. Two new localities were opened up in Greenwood County, in T. 22 S., R. 10 E., and in T. 23 S., R. 9 E., where oil was found in the Teeter sand at a depth of about 2,350 feet, initial production ranging from 100 to 200 barrels. Some success was reported from deep sands below the Mississippi lime, in Montgomery County, and oil from the top of the Ordovician siliceous limestone is obtained in the Graham pool, 3 miles northeast of the Rainbow Bend pool[7] discovered in 1924.

LOUISIANA

Production of petroleum continued to decline in Louisiana, as the output of 21,124,000 barrels in 1924 was a decrease of 15 per cent from that for the preceding year. The decline was confined to the northern part of the State, where the continued drop in the output of the Haynesville and Homer pools more than offset a small gain in the Caddo pool and the production of 1,211,000 barrels in the new Cotton Valley pool. This pool, located in T. 21 N., R. 10 W., in Webster Parish, came in first in 1922 with gas. The rock pressure was 1,120 pounds and wells had an open flow capacity as high as 60,000,000 cubic feet, and for some time it was thought that the field would be similar to other north Louisiana gas fields, which produced large quantities of gas with showings of oil, but not oil in commercial quantities. Oil when found was under high rock pressure, and the initial production of some wells was 1,000 to 10,000 barrels a day. The peak of production apparently was reached in November, 1924. The oil comes from the Blossom sand, a stratum 40 to 50 feet thick in the upper part of the Eagle Ford shales of Upper Cretaceous age. The Cotton Valley structure is one of a group of dome-shaped anticlinal folds that occupies a position on the western flank of the north Louisiana geosyncline and is directly in line with the Bellevue and Haynesville structures.[8]

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[7] Carpenter, Everett, Production of petroleum in 1924: Am. Inst. Min. and Met. Eng., 1925, pp. 152-155.

[8] McDonald, Worth W., The Cotton Valley, La., oil field: Bull. Am. Assoc. Petrol. Geol., vol. 9, 1925, pp. 875-885.

In the Louisiana Gulf coast there was a slightly increased yield. Although the output of the Vinton pool declined slightly there were small gains at Edgerley and Jennings and an output of 128,000 barrels is reported for the new Lockport pool, 7 miles southwest of Lake Charles in Calcasieu Parish. The first well in this pool was brought in September 9, 1924, with an initial daily production of about 5,000 barrels from a sand at a depth of 3,860 to 3,876 feet. At the end of the year the well was flowing about 500 barrels a day.

EASTERN STATES

The Eastern States ranked in the following order among the petroleum-producing States for 1924:

State	Rank	Production (barrels)	Percentage of increase or decrease from 1923	State	Rank	Production (barrels)	Percentage of increase or decrease from 1923
Illinois	8	8, 081, 000	−7. 2	West Virginia	12	5, 920, 000	−6. 9
Pennsylvania	9	7, 486, 000	−1. 6	New York	14	1, 440, 000	+15. 2
Kentucky	10	7, 407, 000	−8. 2	Indiana	15	935, 000	−10. 4
Ohio	11	6, 811, 000	−3. 9	Tennessee	18	10, 000	+25. 0

Declining output is recorded for all of the Eastern States, with the exception of New York and Tennessee. The rate of decline, however, is considerably less in Pennsylvania and Ohio, where improved methods, such as flooding, use of compressed air, etc., in a number of the old pools are tending to maintain production, than in Indiana, Kentucky, Illinois, and West Virginia. The increased output in New York for 1924, the sixth consecutive year in which gains are recorded, is due to the growing practice of flooding the old fields. Flooding is also successfully practiced in the Bradford district in Pennsylvania, but the gains in that area have been offset by losses in other parts of the State, where the relative thinness, irregular stratigraphy, and varying texture of the oil sands are not so well adapted to flooding as in the Bradford district.

The 25 per cent increase in Tennessee is due to the production of about 3,000 barrels from the newly opened Tinsley Bottom field on the Jackson-Clay County line. Oil was found there in October, 1924, at a depth of only 430 feet. The wells came in flowing and soon all available tankage was filled. There are 9 producing wells, 6 in Clay County and 3 in Jackson County. The oil has a gravity of 43.2° (0.810). Further development was suspended pending the construction of a pipe line. The oil horizon is in the Stones River group of the Ordovician.[9]

MONTANA

Montana, producing 2,815,000 barrels of petroleum in 1924, increased its output of the preceding year by 1.2 per cent. The gain was due to the increase of 694,000 barrels in the yield of the Kevin-Sunburst pool, which more than offset the decline of the Cat Creek pool.

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[9] Nelson, Wilbur A., Production of petroleum in 1924: Am. Inst. of Min. and Met. Eng., 1925, pp. 107-111.

The most important new development of the year in Montana was the discovery, in May, 1924, of oil in the Lake Basin field, 35 miles west of Billings. The oil was found in the Hepp well, in section 26, T. 1 N., R. 21 E., on the Big Lake anticline, near a location recommended by the United States Geological Survey for a test well in 1922. The oil, a paraffin-base petroleum of high-grade, was found in the Dakota sand at a depth of 3,825 feet. After flowing for several months, the well was shut in for lack of storage to await further development in the field.[10] Petroleum was not marketed from this field until 1925.

COLORADO AND NEW MEXICO

Colorado and New Mexico, ranking, respectively, sixteenth and seventeenth among the oil-producing States, increased production in 1924 relatively more than any other States.

Colorado in 1924 produced 445,000 barrels of petroleum, contrasted with 86,000 barrels in 1923. The old fields, Florence, Boulder, and Rangley, are reported to have increased their output somewhat, but the new Moffat and Fort Collins fields are chiefly responsible for the gain in the State. The Moffat field is credited with an output of 256,000 barrels in 1924 and the Fort Collins field with 86,000 barrels.

Wegemann reports developments in Colorado as follows:[11]

Finding gas on the Wellington anticline about 10 miles north of Fort Collins in Larimer County by the Union Oil Co. of California in 1923 started the recent boom in Colorado. The presence of this fold had been known for a number of years but it was not drilled because of the depth of the Dakota sand which was estimated at about 4,300 feet. A heavy flow of gas was found in the Union well at 4,285 feet in a sand reported to be near the base of the Benton, which has been correlated with the Muddy sand of Wyoming. In northern Colorado this sand is frequently referred to as the first sand of the Dakota group. The well gaged 82,000,000 cubic feet and could not for some time be controlled. After the well had been flowing unchecked for some days, oil began to appear with the gas.

Closely following the discovery of gas in the Wellington fold came the strike of oil on the Moffat dome, which is about 10 miles southwest of Craig in Moffat County. The structure had been known for a number of years but had not been drilled because of the depth of the sands. The Texas and Transcontinental companies drilled the test well and struck oil in the first sand of the Dakota group at 3,805 feet. The well was estimated to have an initial production of 4,500 barrels but after a short time water appeared with the oil. A pipe line has been laid to Craig and the oil is shipped over the Moffat Road. The oil has a specific gravity of 41° (0.820).

These discoveries of oil and gas both east and west of the Front Range in Colorado were followed by an intensive examination of structure in many parts of the State and by an extensive drilling campaign. Soon after the discovery of the Fort Collins field oil was found in the Iles dome in Moffat County, immediately west of the Moffat dome, at a depth of 2,550 feet, occurring in crevices in the shale above the first sand of the Dakota group. The gravity of this oil is about 38° (0.835). The first sand of the Dakota was encountered at 2,630 feet and was found to contain both oil and water; the oil had a gravity of 26.2° (0.897).

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[10] Bauer, C. Max, Petroleum development in Montana: Petroleum in 1924, Am. Inst. Min. and Met. Eng., 1925, pp. 156–158.

[11] Wegemann, Carroll H., Oil and gas in Colorado: Production of petroleum in 1924, Am. Inst. Min. and Met. Eng., 1925, pp. 168–181.

In December, 1924, a well was completed on the Tow Creek structure which yielded oil in commercial quantity. The first shipments were made in January, 1925, over the Moffat Road. A flow of gas was found at 1,600 feet and at 2,075 feet a flow of 10,000,000 cubic feet was developed. An oil flow was found at 2,290 feet, oil in shale at 2,320 to 2,340, and more oil between 2,515 and 2,530 feet. The gravity of the oil is 35° (0.850).

Natural gas was discovered on the Carbonera fold in the southwestern part of Garfield County in November, 1924. The gas, estimated at 51,000,000 cubic feet under a rock pressure of 800 pounds, was encountered in the first sand of the Dakota group at a depth of 2,860 feet.

New Mexico is credited with an output of 98,000 barrels in 1924. An outlet for the oil produced in the Hogback anticline in San Juan County, discovered in 1923, was obtained by the construction of a pipe line to a loading rack at Farmington. This field is credited with a production of about 86,000 barrels in 1924. The Rattlesnake Dome in San Juan County, west of the Hogback field, was proved for oil during the year. Renewed activity in the Artesia field in Eddy County paved the way for it to become the leading producer in the State in 1925. This field is an extension of the old one near Dayton, from which an almost negligible quantity of oil has been obtained each year since 1913.

UTAH

In Utah there are two producing fields, one in San Juan County and the other near Virgin City in Washington County, which have reported a small output for a number of years. A gas well having an estimated initial capacity of 90,000,000 cubic feet was brought in near Cisco in Grand County in October, 1924.

ALASKA

In Alaska in 1924, as in previous years, the oil production was obtained from the Katalla field, near Controller Bay, in the south central corner of the Territory. The production came from 16 small wells on patented claims. The oil is refined near the wells and the products have a ready sale. To avoid disclosing the operations of individual companies, the production of petroleum in Alaska is given under "Other" in the tables on pages 399–402.

Explorations by the United States Geological Survey in Naval Oil Reserve No. 4, situated in the extreme northern part of Alaska, which began in 1923,[12] were continued in 1924 and 1925. There are large seepages of oil in this reserve at Cape Simpson, about 50 miles southeast of Point Barrow. The reserve is therefore being studied to determine whether or not it contains an extensive oil field. In 1925 the Geological Survey also made examinations with reference to oil resources in the Alaska Peninsula where two wells were drilled in the Pearl Creek dome, in the Cold Bay district. Both wells give showings of oil and it is reported that the structure will be thoroughly tested.

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[12] Paige, Sidney, Foran, W. T., and Gilluly, James: A reconnaissance of the Point Barrow region: U. S. Geol. Survey Bull. 772, 1925, 33 pp.

Petroleum produced in the

[Thousands of barrels

Year	New York	Pennsylvania	West Virginia	Kentucky	Tennessee	Ohio	Indiana	Illinois	Kansas	Oklahoma
1859–1875	(b)	[b] 74,072	------	------	------	------	------	------	------	------
1876	(b)	[b] 8,969	120	------	------	32	------	------	------	------
1877	(b)	[b] 13,135	172	------	------	30	------	------	------	------
1878	(b)	[b] 15,164	180	------	------	38	------	------	------	------
1879	(b)	[b] 19,685	180	------	------	29	------	------	------	------
1880	(b)	[b] 26,028	179	------	------	39	------	------	------	------
1881	(b)	[b] 27,376	151	------	------	34	------	------	------	------
1882	6,685	23,368	128	------	------	40	------	------	------	------
1883	4,004	19,125	126	[c] 5	(c)	47	------	------	------	------
1884	3,231	20,541	90	[c] 4	(c)	90	------	------	------	------
1885	2,658	18,118	91	[c] 5	(c)	662	------	------	------	------
1886	2,151	23,647	102	[c] 5	(c)	1,783	------	------	------	------
1887	2,075	20,281	145	[c] 5	(c)	5,023	------	------	------	------
1888	(b)	[b] 16,489	119	[c] 5	(c)	10,011	------	------	------	------
1889	1,897	19,591	544	[c] 5	(c)	12,472	33	1.5	0.5	------
1890	(b)	[b] 28,458	493	[c] 6	(c)	16,125	64	1	1	------
1891	1,585	31,424	2,406	[c] 9	(c)	17,740	137	.5	1.5	(d)
1892	1,273	27,149	3,810	[c] 7	(c)	16,363	698	1	5	(d)
1893	1,032	19,283	8,446	[c] 3	(c)	16,249	2,335	1	18	(d)
1894	942	18,078	8,577	[c] 2	(c)	16,792	3,689	(d)	40	(d)
1895	913	18,231	8,120	[c] 2	(c)	19,545	4,386	(d)	44	(d)
1896	1,205	19,379	10,020	[c] 2	(c)	23,941	4,681	(d)	114	(d)
1897	1,279	17,983	13,090	(c d)	(c)	21,561	4,122	1	81	1
1898	1,205	14,743	13,615	[c] 6	(c)	18,739	3,731	(d)	72	------
1899	1,321	13,054	13,911	[c] 18	(c)	21,142	3,848	(d)	70	------
1900	1,301	13,258	16,196	[c] 62	(c)	22,363	4,874	(d)	75	6
1901	1,207	12,625	14,177	[c] 137	(c)	21,648	5,757	(d)	179	10
1902	1,120	12,064	13,513	[c] 185	(c)	21,014	7,481	(d)	332	37
1903	1,163	11,355	12,900	[c] 554	(c)	20,480	9,186	------	932	139
1904	1,113	11,126	12,645	[c] 998	(c)	18,877	11,339	------	4,251	1,367
1905	1,118	10,437	11,578	[c]1,217	(c)	16,347	10,964	181	[e]12,014	(e)
1906	1,243	10,257	10,121	[c]1,214	(c)	14,788	7,674	4,397	[e]21,718	(e)
1907	1,212	10,000	9,095	[c] 821	(c)	12,207	5,128	24,282	2,410	43,524
1908	1,160	9,424	9,523	728	------	10,859	3,283	33,686	1,801	45,799
1909	1,135	9,299	10,745	639	------	10,633	2,296	30,898	1,264	47,859
1910	1,054	8,795	11,753	469	------	9,916	2,160	33,143	1,128	52,029
1911	953	8,248	9,796	472	------	8,817	1,695	31,317	1,279	56,069
1912	874	7,838	12,129	484	------	8,969	970	28,602	1,593	51,427
1913	948	7,917	11,567	525	------	8,781	956	23,894	2,375	63,579
1914	939	8,170	9,680	503	------	8,536	1,336	21,920	3,104	73,632
1915	888	7,838	9,265	437	------	7,825	876	19,042	2,823	97,915
1916	874	7,593	8,731	1,202	1	7,744	769	17,714	8,738	107,072
1917	880	7,733	8,379	3,088	12	7,751	760	15,777	36,536	107,508
1918	809	7,408	7,867	4,368	8	7,285	878	13,366	45,451	103,347
1919	851	8,137	8,327	9,278	15	7,736	972	11,960	33,048	86,911
1920	906	7,438	8,249	8,738	14	7,400	945	10,774	39,005	106,206
1921	988	7,418	7,822	9,013	12	7,335	1,158	10,043	36,456	114,634
1922	1,000	7,425	7,021	8,973.2	9.8	6,781	1,087	9,383	31,766	149,571
1923	1,250	7,609	6,358	8,069	8	7,085	1,043	8,707	28,250	160,929
1924	1,440	7,486	5,920	7,407	10	6,811	935	8,081	28,836	173,538
	[g] 59,882	[g] 780,269	338,172	69,670.2	89.8	506,515	112,246	357,173	345,811	1,643,109
Percentage of total production	0.8	9.9	4.3	0.9	------	6.4	1.4	4.5	4.4	20.8

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[a] 1889–1899, Missouri; 1900–1906, Michigan and Missouri; 1907–1911, Michigan, Missouri, and Utah; 1912, 1917, 1918, Alaska and Michigan; 1913 and 1919, Alaska, Michigan, Missouri, and New Mexico; 1914–1916, Alaska, Michigan, and Missouri; 1920, Alaska, Arkansas, Missouri, New Mexico, and Utah; 1921–1923, Alaska, Missouri, and New Mexico; 1924, Alaska and Utah.

[b] New York included with Pennsylvania.

[c] Tennessee included with Kentucky.

United States, 1859–1924

of 42 U. S. gallons]

Arkansas	Louisiana	Texas	Montana	Wyoming	Colorado	New Mexico	California	Other[a]	United States	Value at wells	
										Total (thousands of dollars)	Average per barrel
-------	-------	-------	-------	-------	-------	-------	-------	-------	74, 072	215, 781	$2. 91
-------	-------	-------	-------	-------	-------	-------	12	-------	9, 133	22, 983	2. 52
-------	-------	-------	-------	-------	-------	-------	13	-------	13, 350	31, 789	2. 38
-------	-------	-------	-------	-------	-------	-------	15	-------	15, 397	18, 045	1. 17
-------	-------	-------	-------	-------	-------	-------	20	-------	19, 914	17, 211	. 86
-------	-------	-------	-------	-------	-------	-------	40	-------	26, 286	24, 601	. 94
-------	-------	-------	-------	-------	-------	-------	100	-------	27, 661	25, 448	. 92
-------	-------	-------	-------	-------	-------	-------	129	-------	30, 350	23, 631	. 78
-------	-------	-------	-------	-------	-------	-------	143	-------	23, 450	25, 790	1. 10
-------	-------	-------	-------	-------	-------	-------	262	-------	24, 218	20, 596	. 85
-------	-------	-------	-------	-------	-------	-------	325	-------	21, 859	19, 198	. 88
-------	-------	-------	-------	-------	-------	-------	377	-------	28, 065	19, 996	. 71
-------	-------	-------	-------	-------	76	-------	678	-------	28, 283	18, 877	. 67
-------	-------	-------	-------	-------	298	-------	690	-------	27, 612	17, 948	. 65
-------	-------	(d)	-------	-------	317	-------	303	(a d)	35, 164	26, 963	. 77
-------	-------	(d)	-------	-------	369	-------	307	(a d)	45, 824	35, 365	. 77
-------	-------	(d)	-------	-------	666	-------	324	(a d)	54, 293	30, 527	. 56
-------	-------	(d)	-------	-------	824	-------	385	(a d)	50, 515	25, 907	. 51
-------	-------	(d)	-------	-------	594	-------	470	(a d)	48, 431	28, 950	. 60
-------	-------	(d)	-------	2	516	-------	706	(a d)	49, 344	35, 522	. 72
-------	-------	(d)	-------	4	438	-------	1, 209	(a d)	52, 892	57, 632	1. 09
-------	-------	1	-------	3	361	-------	1, 253	(a d)	60, 960	58, 519	. 96
-------	-------	66	-------	4	385	-------	1, 903	(a d)	60, 476	40, 874	. 68
-------	-------	546	-------	6	444	-------	2, 257	(a d)	55, 364	44, 193	. 80
-------	-------	669	-------	6	390	-------	2, 642	(a d)	57, 071	64, 604	1. 13
-------	-------	836	-------	6	317	-------	4, 325	2	63, 621	75, 989	1. 19
-------	-------	4, 394	-------	5	461	-------	8, 787	2	69, 389	66, 417	. 96
-------	549	18, 084	-------	6	397	-------	13, 984	1	88, 767	71, 179	. 80
-------	918	17, 956	-------	9	484	-------	24, 382	3	100, 461	94, 694	. 94
-------	2, 959	22, 241	-------	12	501	-------	29, 649	3	117, 081	101, 175	. 86
-------	8, 910	28, 136	-------	8	376	-------	33, 428	3	134, 717	84, 157	. 62
-------	9, 077	12, 568	-------	7	328	-------	33, 099	3	126, 494	92, 445	. 73
-------	5, 000	12, 323	-------	9	332	-------	39, 748	4	166, 095	120, 107	. 72
-------	5, 789	11, 207	-------	18	380	-------	44, 855	15	178, 527	129, 079	. 72
-------	3, 060	9, 534	-------	20	311	-------	55, 472	6	183, 171	128, 329	. 70
-------	6, 841	8, 899	-------	115	240	-------	73, 011	4	209, 557	127, 900	. 61
-------	10, 721	9, 526	-------	187	227	-------	81, 134	8	220, 449	134, 045	. 61
-------	9, 263	11, 735	-------	1, 572	206	-------	87, 269	4	222, 935	164, 213	. 74
-------	12, 499	15, 010	-------	2, 407	189	(f)	97, 788	11	248, 446	237, 121	. 95
-------	14, 309	20, 068	-------	3, 560	223	-------	99, 775	8	265, 763	214, 125	. 81
-------	18, 192	24, 943	-------	4, 246	208	-------	86, 592	14	281, 104	179, 463	. 64
-------	15, 248	27, 645	45	6, 234	197	-------	90, 952	8	300, 767	330, 900	1. 10
-------	11, 392	32, 413	100	8, 978	121	-------	93, 878	10	335, 316	522, 635	1. 56
-------	16, 043	38, 750	69	12, 596	143	-------	97, 532	8	355, 928	703, 944	1. 98
-------	17, 188	79, 366	90	13, 172	121	(f)	101, 183	12	378, 367	760, 266	2. 01
-------	35, 714	96, 868	340	16, 831	111	(f)	103, 377	13	442, 929	1, 360, 745	3. 07
10, 473	27, 103	106, 166	1, 509	19, 333	108	(f)	112, 600	12	472, 183	814, 745	1. 73
12, 712	35, 376	118, 684	2, 449	26, 715	97	(f)	138, 468	13	557, 531	895, 111	1. 61
36, 610	24, 919	131, 023	2, 782	44, 785	86	(f)	262, 876	18	732, 407	978, 430	1. 34
46, 028	21, 124	134, 522	2, 815	39, 498	445	98	228, 933	13	713, 940	1, 022, 683	1. 43
105, 823	312, 194	994, 179	10, 199	200, 354	12, 287	[h] 98	2, 057, 660	198	7, 905, 929	10, 360, 847	-------
1. 3	3. 9	12. 6	0. 1	2. 5	0. 2	-------	26. 0	-------	100. 0	-------	-------

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[d] Less than 500 barrels. See Mineral Resources, 1916, pt. 2, pp. 684–685.
[e] Oklahoma included with Kansas.
[f] Included under "Other."
[g] Early production in New York included with Pennsylvania.
[h] Figures represent 1924 production only. Earlier years included under "Other."

Petroleum produced in the United States, 1923–24, by fields

[Thousands of barrels of 42 U. S. gallons]

Field	January	February	March	April	May	June	July	August	September	October	November	December	The year	Value at wells	
														Total (thousands of dollars)	Average per barrel
1923															
Appalachian	2,407	2,064	2,428	2,366	2,493	2,403	2,325	2,474	2,321	2,485	2,208	2,251	28,225	78,886	$2.79
Lima-Indiana	194	157	206	196	212	215	210	213	206	217	189	189	2,404	4,820	2.00
Illinois and southwestern Indiana	844	703	871	731	857	809	813	817	759	797	755	744	9,500	17,690	1.86
Mid-Continent	26,257	23,686	27,832	28,760	30,672	30,252	29,997	29,090	29,033	32,408	32,882	27,591	348,460	535,060	1.54
Gulf coast [a]	3,260	2,662	2,785	2,682	2,871	2,844	2,891	2,941	2,750	2,680	2,452	2,453	33,271	46,120	1.39
Rocky Mountain	3,202	2,988	3,360	3,702	3,861	3,793	4,455	4,468	4,492	4,371	4,517	4,444	47,653	53,082	1.11
California	16,362	16,327	19,485	20,570	21,409	22,528	25,232	26,417	25,744	24,546	22,384	21,872	262,876	242,731	.92
Other [b]	1	1	2	1	2	1	2	2	1	2	1	2	18	41	2.28
	52,527	48,588	56,969	59,008	62,377	62,845	65,925	66,422	65,306	67,506	65,388	59,546	732,407	978,430	1.34
1924															
Appalachian	2,100	2,104	2,268	2,343	2,361	2,254	2,416	2,251	2,298	2,434	2,075	2,152	27,056	80,855	2.99
Lima-Indiana	162	181	202	209	210	211	207	192	194	202	157	160	2,287	4,550	1.99
Illinois and southwestern Indiana	683	705	786	680	775	749	784	744	738	767	672	664	8,747	15,420	1.76
Mid-Continent	26,923	27,375	30,822	31,075	32,684	31,822	32,966	33,882	33,120	32,668	31,116	31,026	375,479	549,570	1.46
Gulf coast [a]	2,321	2,432	2,538	2,273	2,395	2,303	2,519	2,352	2,339	2,589	2,333	2,175	28,569	44,620	1.56
Rocky Mountain [c]	4,389	3,951	3,823	4,156	3,789	3,640	3,740	3,846	3,363	3,092	2,642	2,438	42,869	53,015	1.24
California	20,695	19,141	19,702	19,094	19,620	18,604	19,300	19,131	18,324	18,717	17,787	18,818	228,933	274,653	1.20
	57,273	55,889	60,141	59,830	61,834	59,583	61,932	62,398	60,376	60,469	56,782	57,433	713,940	1,022,683	1.43

[a] Salt-dome pools.
[b] Alaska, Missouri, and New Mexico.
[c] Includes Alaska.

Petroleum produced in the United States, 1923–24, by States

[Thousands of barrels of 42 U. S. gallons]

State	January	February	March	April	May	June	July	August	September	October	November	December	The year	Value at wells (thousands of dollars)
1923														
Arkansas	2,830	2,281	3,222	3,117	3,463	3,287	3,092	3,042	3,282	3,273	2,911	2,810	36,610	25,400
California [a]	16,362	16,327	19,485	20,570	21,409	22,528	25,232	26,417	25,744	24,546	22,384	21,872	[a] 262,876	[a] 242,731
Colorado	6.9	5.5	5.8	6.4	9.1	7.5	6.9	8.2	7.9	7.6	7.7	6.5	86	102
Illinois	773	643	807	662	784	739	745	747	696	733	693	685	8,707	16,250
Indiana:														
Southwestern	71	60	64	69	73	70	68	70	63	64	62	59	793	1,440
Northeastern	21	16	19	19	19	20	22	25	24	27	18	20	250	460
Total Indiana	92	76	83	88	92	90	90	95	87	91	80	79	1,043	1,900
Kansas	2,463	2,155	2,549	2,681	2,812	2,595	2,300	2,005	1,821	2,164	2,371	2,334	28,250	45,970
Kentucky	746.3	643.3	675.4	674.4	670	688.3	611.7	736	670.7	685.3	628.3	639.3	8,069	15,900
Louisiana:														
Gulf coast [b]	202	183	217	204	214	209	208	208	210	204	197	194	2,450	3,340
Northern	2,185	1,876	2,190	2,026	2,046	1,849	1,887	1,868	1,687	1,687	1,588	1,580	22,469	33,190
Total Louisiana	2,387	2,059	2,407	2,230	2,260	2,058	2,095	2,076	1,897	1,891	1,785	1,774	24,919	36,530
Montana	255	209	234	249	225	225	271	280	276	211	169	178	2,782	4,080
New York	88	76	90	99	106	104	110	105	140	115	105	112	1,250	4,140
Ohio:														
Central and eastern	413	349	424	414	434	411	422	421	404	436	403	400	4,931	12,690
Northwestern	173	141	187	177	193	195	188	188	182	190	171	169	2,154	4,360
Total Ohio	586	490	611	591	627	606	610	609	586	626	574	569	7,085	17,050
Oklahoma	12,716	11,988	13,639	14,843	15,818	15,888	14,586	13,058	11,711	11,939	12,508	12,235	160,929	279,700
Pennsylvania	644	523	667	650	700	655	643	652	603	673	594	605	7,609	25,320
Tennessee	.7	.7	.6	.6	1	.7	.3	1	.3	.7	.7	.7	8	14
Texas:														
Gulf coast [b]	3,058	2,479	2,568	2,478	2,657	2,635	2,683	2,733	2,540	2,476	2,255	2,259	30,821	42,780
Rest of State	6,063	5,386	6,232	6,093	6,533	6,633	8,132	9,117	10,532	13,345	13,504	8,632	100,202	150,800
Total Texas	9,121	7,865	8,800	8,571	9,190	9,268	10,815	11,850	13,072	15,821	15,759	10,891	131,023	193,580
West Virginia	515	472	571	528	582	544	538	559	503	575	477	494	6,358	20,822
Wyoming	2,940.1	2,773.5	3,120.2	3,446.6	3,626.9	3,560.5	4,177.1	4,179.8	4,208.1	4,152.4	4,340.3	4,259.5	44,785	48,900
Other [c]	1	1	2	1	2	1	2	2	1	2	1	2	18	41
United States	52,527	48,588	56,969	59,008	62,377	62,845	65,925	66,422	65,306	67,506	65,388	59,546	732,407	978,430

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[a] Annual and semiannual figures from California State Mining Bureau. Monthly figures for California prorated on basis of monthly reports by the American Petroleum Institute.

[b] Salt-dome pools.

[c] Alaska, Missouri, and New Mexico.

Petroleum produced in the United States, 1923–24, by States—Continued

[Thousands of barrels of 42 U. S. gallons]

State	January	February	March	April	May	June	July	August	September	October	November	December	The year	Value at wells (thousands of dollars)
1924														
Arkansas	2, 952	3, 111	3, 776	3, 985	4, 588	4, 308	4, 538	4, 331	3, 925	3, 883	3, 462	3, 169	46, 028	43, 130
California [a]	20, 695	19, 141	19, 702	19, 094	19, 620	18, 604	19, 300	19, 131	18, 324	18, 717	17, 787	18, 818	[a] 228,933	[a] 274, 653
Colorado	6	8	8	8	8	10	48	85	77	66	65	56	445	490
Illinois	631	650	734	619	713	691	722	689	684	710	623	615	8, 081	14, 220
Indiana:														
Southwestern	52	55	52	61	62	58	62	55	54	57	49	49	666	1, 200
Northeastern	18	22	24	27	27	26	26	23	22	22	16	16	269	520
Total Indiana	70	77	76	88	89	84	88	78	76	79	65	65	935	1, 720
Kansas	2, 113	2, 131	2, 276	2, 341	2, 513	2, 399	2, 460	2, 678	2, 609	2, 630	2, 431	2, 255	28, 836	44, 400
Kentucky	586. 4	596. 3	636. 4	643. 4	647. 7	611. 4	677. 4	615. 6	625. 2	631. 6	566. 3	569. 3	7, 407	14, 592
Louisiana:														
Gulf coast [b]	192	176	192	171	193	201	210	199	220	270	231	232	2, 487	4, 050
Northern	1, 534	1, 429	1, 500	1, 494	1, 704	1, 605	1, 652	1, 651	1, 566	1, 571	1, 513	1, 418	18, 637	26, 290
Total Louisiana	1, 726	1, 605	1, 692	1, 665	1, 897	1, 806	1, 862	1, 850	1, 786	1, 841	1, 744	1, 650	21, 124	30, 340
Montana	153	144	174	268	266	245	249	284	294	274	241	223	2, 815	3, 754
New Mexico	1	1	1	1	1	1	1	19	21	19	16	16	98	127
New York	106	106	117	119	128	118	130	118	133	129	114	122	1, 440	5, 245
Ohio:														
Central and eastern	368	358	393	409	408	391	419	401	411	440	386	409	4, 793	13, 135
Northwestern	144	159	178	182	183	185	181	169	172	180	141	144	2, 018	4, 030
Total Ohio	512	517	571	591	591	576	600	570	583	620	527	553	6, 811	17, 165
Oklahoma	12, 109	12, 448	13, 262	13, 850	14, 181	14, 262	15, 041	16, 032	16, 109	15, 713	15, 258	15, 273	173, 538	272, 450
Pennsylvania	560	562	626	659	669	638	665	628	638	692	566	583	7, 486	27, 025
Tennessee	. 6	. 7	. 6	. 6	. 3	. 6	. 6	. 4	. 8	. 4	1. 7	2. 7	10	18
Texas:														
Gulf coast [b]	2, 129	2, 256	2, 346	2, 102	2, 202	2, 102	2, 309	2, 153	2, 119	2, 319	2, 102	1, 943	26, 082	40, 570
Rest of State	8, 215	8, 256	10, 008	9, 405	9, 698	9, 248	9, 275	9, 190	8, 911	8, 871	8, 452	8, 911	108, 440	163, 300
Total Texas	10, 344	10, 512	12, 354	11, 507	11, 900	11, 350	11, 584	11, 343	11, 030	11, 190	10, 554	10, 854	134, 522	203, 870
West Virginia	479	481	495	512	508	495	524	488	490	541	441	466	5, 920	20, 840
Wyoming	4, 228	3, 797	3, 639	3, 878	3, 513	3, 383	3, 441	3, 457	2, 970	2, 732	2, 319	2, 141	39, 498	48, 600
Other [c]	1	1	1	1	1	1	1	1	1	1	1	2	13	44
United States	57, 273	55, 889	60, 141	59, 830	61, 834	59, 583	61, 932	62, 398	60, 376	60, 469	56, 782	57, 433	713, 940	1, 022, 683

[a] Annual and semiannual figures from California State Mining Bureau. Monthly figures for California prorated on basis of monthly reports by the American Petroleum Institute.

[b] Salt-dome pools.

[c] Alaska and Utah.

Petroleum produced in the United States, 1923–24, classified by gravity (approximate)

[Thousands of barrels of 42 U. S. gallons]

	January	February	March	April	May	June	July	August	September	October	November	December	The year	Percentage of total
1923														
Light crude (24° (0.910) and lighter)	41, 617	38, 922	46, 087	48, 097	50, 918	51, 316	54, 365	54, 773	53, 771	55, 984	54, 558	48, 084	598, 492	82
Heavy crude (heavier than 24° A. P. I.)	10, 910	9, 666	10, 882	10, 911	11, 459	11, 529	11, 560	11, 649	11, 535	11, 522	10, 830	11, 462	133, 915	18
	52, 527	48, 588	56, 969	59, 008	62, 377	62, 845	65, 925	66, 422	65, 306	67, 506	65, 388	59, 546	732, 407	100
1924														
Light crude (24° (0.910) and lighter)	45, 342	43, 384	45, 951	45, 409	46, 279	44, 566	46, 374	47, 454	46, 195	45, 775	43, 040	43, 909	543, 678	76
Heavy crude (heavier than 24° A. P. I.)	11, 931	12, 505	14, 190	14, 421	15, 555	15, 017	15, 558	14, 944	14, 181	14, 694	13, 742	13, 524	170, 262	24
	57, 273	55, 889	60, 141	59, 830	61, 834	59, 583	61, 932	62, 398	60, 376	60, 469	56, 782	57, 433	713, 940	100

Petroleum produced in Kentucky and Pennsylvania, 1922–1924, by counties, in barrels

Kentucky [a]				Pennsylvania [b]			
County	1922	1923	1924	County	1922	1923	1924
Allen	641, 556	476, 980	371, 460	Allegheny	574, 552	561, 398	467, 265
Barren	68, 702	81, 046	108, 457	Armstrong	24, 788	24, 266	21, 350
Bath	17, 622	17, 131	17, 685	Beaver	117, 914	109, 140	91, 973
Boyd	1, 252	1, 029	1, 242	Butler	825, 366	781, 402	735, 900
Clinton			1, 363	Clarion	212, 206	210, 914	203, 685
Cumberland	11, 806	21, 908	81, 217	Crawford	48, 406	59, 024	56, 613
Elliott		395	7, 271	Elk	109, 244	101, 642	100, 701
Estill	729, 393	588, 642	498, 957	Forest	87, 226	82, 707	87, 369
Floyd	4, 834	5, 278	14, 126	Greene	317, 343	274, 229	249, 871
Hancock	2, 625	31, 398	36, 657	Jefferson	10, 036	9, 237	8, 436
Hopkins		4, 903	12, 912	Lawrence	31, 825	28, 654	24, 215
Jackson	2, 299	1, 896	582	McKean	2, 466, 723	2, 490, 696	[c] 2,374,775
Johnson	666, 758	1, 015, 006	1, 178, 675	Mercer	12, 954	13, 643	13, 503
Knott	3, 113	3, 194	2, 922	Potter	13, 375	12, 135	10, 011
Lawrence	402, 196	467, 042	512, 286	Tioga	8, 779	7, 712	6, 836
Lee	3, 429, 481	2, 655, 285	2, 236, 840	Venango	1, 360, 093	1, 304, 206	1, 236, 568
Lincoln	633	500	114	Warren	516, 781	522, 107	326, 852
Logan	3, 766	567		Washington	499, 893	474, 765	478, 483
Magoffin	1, 234, 373	1, 348, 623	1, 105, 378	Westmoreland	233	215	257
Martin	190	25	12				
McCreary	6, 399	5, 276	4, 405		7, 237, 737	7, 068, 092	[c] 6, 494, 663
Menifee	13, 297	5, 683	3, 156	Bureau of Mines	7, 425, 000	7, 609, 000	[c] 7, 486, 000
Monroe	68	10, 819	48, 491				
Morgan	11, 126	9, 223	9, 410				
Ohio	1, 266	9, 789	78, 631				
Owsley		2, 528	10, 879				
Powell	207, 124	282, 393	264, 483				
Russell	2, 235	6, 828	9, 409				
Simpson	62, 810	22, 319	11, 252				
Warren	1, 112, 245	762, 036	580, 225				
Wayne	189, 615	142, 168	126, 139				
Whitley	265	120					
Wolfe	86, 651	67, 440	57, 557				
	8, 913, 700	8, 047, 470	7, 392, 193				
Bureau of Mines	8, 973, 200	8, 069, 000	7, 407, 000				

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[a] Kentucky State Tax Commission.

[b] Department of Internal Affairs, Pennsylvania.

[c] The figures of the Bureau of Mines include 771,000 barrels reported for McKean County which is not included in the figures of the Pennsylvania Department of Internal Affairs.

Petroleum produced in Texas, 1914–1924, by districts

[Thousands of barrels of 42 U. S. gallons]

Year	Gulf coast (salt-dome pools)										
	Batson	Big Creek	Blue Ridge	Damon Mound	Dayton	Goose Creek	Hull	Humble	Markham	Orange	Pierce Junction
1914	776				19	135		2, 799	163	43	
1915	704				10	119		11, 062	137	22	
1916	745				9	397		10, 926	157	18	
1917	693			[a] 124	10	7, 300		7, 390	127	7	
1918	635			[a] 283	9	[b] 8, 944	245	6, 555	65		
1919	560			191	8	[b] 5, 770	1, 273	3, 706	54		
1920	527		92	379	17	[b] 4, 476	3, 909	3, 607	57		
1921	495		326	666	40	[b] 4, 640	8, 150	3, 004	49	470	1, 239
1922	434	(c)	349	754	29	[b] 4, 766	6, 546	2, 284	35	5, 345	1, 020
1923	403	(c)	287	628	35	[b] 6, 026	7, 300	2, 275	21	4, 649	313
1924	464	293	278	520	36	[b] 3, 967	7, 074	2, 224	66	3, 958	154

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[a] Damon Mound includes West Columbia.

[b] Includes Barbers Hill.

[c] Included under "Other."

Petroleum produced in Texas, 1914–1924, by districts—Continued

[Thousands of barrels of 42 U. S. gallons]

Year	Gulf coast (salt-dome pools)—Continued						Rest of State				
								East and south central Texas			
	Saratoga	Sour-lake	Spindle-top	West Columbia	Other	Total	Calliham	Corsicana, Currie, Mexia, Powell, Richland, Wortham	Luling	Somerset	Thrall-Minerva
1914	890	5, 209	580		3	10, 617		416			
1915	864	4, 115	388		48	17, 469		381			613
1916	781	4, 923	341		45	18, 342		361			433
1917	683	4, 763	380	([a])	36	21, 513		329			177
1918	722	3, 408	557	([a])	47	21, 470		313			137
1919	737	2, 709	407	5, 611	31	21, 057		269		43	91
1920	849	2, 024	322	9, 459	17	25, 735		297		162	60
1921	1, 129	1, 802	344	12, 081	6	34, 441		6, 137		324	52
1922	713	1, 675	289	11, 126	5	35, 370		34, 790		672	37
1923	626	1, 906	326	5, 994	32	30, 821		50, 827	2, 248	1, 030	247
1924	543	1, 588	359	4, 536	22	26, 082	187	49, 272	11, 134	1, 109	235

Year	Rest of State—Continued									Total for State
	East and south central Texas—Continued			North central Texas [d]	West Texas				Total	
	Webb-Zapata-Jim Hogg	Other	Total		Big Lake	Carson and Hutchinson Counties	Westbrook	Total		
1914		181	597	8, 854					9, 451	20, 068
1915		123	1, 117	6, 357					7, 474	24, 943
1916		65	859	8, 444					9, 303	27, 645
1917		58	564	10, 336					10, 900	32, 413
1918		48	498	16, 782					17, 280	38, 750
1919		60	463	57, 846					58, 309	79, 366
1920		51	570	70, 563					71, 133	96, 868
1921		48	6, 561	65, 164					71, 725	106, 166
1922	733	35	36, 267	47, 037			10	10	83, 314	118, 684
1923	1, 786	38	56, 176	43, 896	12		118	130	100, 202	131, 023
1924	2, 215	59	64, 211	42, 487	1, 056	272	414	1, 742	108, 440	134, 522

[a] Damon Mound includes West Columbia.

[d] Includes the districts in and between Wilbarger, Wichita, and Clay Counties on the north and Coleman, Brown, and Comanche Counties on the south.

Petroleum produced in coastal Texas salt-dome pools, 1923–24, by districts and months

[Thousands of barrels of 42 U. S. gallons]

District	Petroleum transported from producing properties													Oil consumed on leases plus net change in producers' stocks, Jan. 1-Dec. 31	Production
	January	February	March	April	May	June	July	August	September	October	November	December	The year		
1923															
Batson	30	20	36	30	35	35	35	35	34	36	30	33	389	14	403
Blue Ridge	19	16	14	15	24	55	21	27	23	21	16	14	265	22	287
Damon Mound	62	58	60	51	56	54	51	48	45	48	45	45	623	5	628
Dayton	4	2	3	2	3	3	2	3	2	3	4	3	34	1	35
Goose Creek [a]	554	506	550	549	563	526	515	434	439	412	367	387	5,802	224	6,026
Hull	840	523	490	500	529	510	560	709	620	610	534	530	6,955	345	7,300
Humble	198	186	203	192	192	175	179	179	165	166	139	140	2,114	161	2,275
Markham	1	2	2	2	2	2	1	2	2	2	1	1	20	1	21
Orange	342	302	315	294	327	420	440	494	425	401	392	353	4,505	144	4,649
Pierce Junction	19	20	17	42	25	25	19	14	13	18	17	26	255	58	313
Saratoga	53	43	53	49	48	48	49	48	48	48	45	41	573	53	626
Sourlake	141	123	148	157	174	175	180	162	161	150	131	137	1,839	67	1,906
Spindletop	25	23	26	26	28	29	29	27	29	27	27	28	324	2	326
West Columbia	641	537	523	445	523	454	473	422	409	405	383	392	5,607	387	5,994
Other	1	-----	-----	-----	-----	-----	1	1	1	1	-----	1	6	26	32
	2,930	2,361	2,440	2,354	2,529	2,511	2,555	2,605	2,416	2,348	2,131	2,131	29,311	1,510	30,821
1924															
Batson	27	33	38	39	46	38	41	39	38	40	32	41	452	12	464
Big Creek	-----	-----	-----	-----	-----	-----	-----	-----	-----	166	93	11	270	23	293
Blue Ridge	16	11	16	17	30	24	25	18	20	16	18	18	229	49	278
Damon Mound	41	38	42	39	41	41	40	35	35	34	35	29	450	70	520
Dayton	7	4	5	3	3	3	2	2	2	1	1	1	34	2	36
Goose Creek [a]	382	376	396	335	321	294	327	299	304	357	281	275	3,947	20	3,967
Hull	525	768	681	588	584	583	627	582	504	466	460	425	6,793	281	7,074
Humble	134	134	137	147	173	231	211	220	183	183	177	171	2,101	123	2,224
Markham	1	2	2	2	12	11	1	1	2	4	5	7	50	16	66
Orange	322	265	317	312	322	291	316	341	303	327	347	319	3,782	176	3,958
Pierce Junction	18	17	15	16	11	9	8	7	5	7	15	10	138	16	154
Saratoga	37	36	89	46	95	24	122	22	24	61	68	62	686	−143	543
Sourlake	136	129	137	128	133	126	133	129	121	120	106	108	1,506	82	1,588
Spindletop	26	25	27	27	27	28	28	29	30	39	34	37	357	2	359
West Columbia	393	359	379	342	340	339	361	365	486	431	367	364	4,526	10	4,536
Other	-----	1	1	1	-----	-----	3	-----	2	3	3	1	15	7	22
	2,065	2,198	2,282	2,042	2,138	2,042	2,245	2,089	2,059	2,255	2,042	1,879	25,336	746	26,082

[a] Includes Barbers Hill.

Petroleum produced in east and south central, north central, and west Texas, 1923–24, by districts and months

[Thousands of barrels of 42 U. S gallons]

District	Petroleum transported from producing properties													Oil consumed on leases plus net change in producers' stocks, Jan. 1–Dec. 31	Production
	January	February	March	April	May	June	July	August	September	October	November	December	The year		
1923															
East and south central Texas:															
Corsicana-Currie-Mexia-Powell	2,036	1,845	2,170	1,876	1,973	2,090	3,723	4,990	6,543	9,189	9,256	4,477	50,168	659	50,827
Luling	------	------	------	------	------	------	63	231	419	500	477	467	2,157	91	2,248
Somerset	81	74	99	97	90	87	90	87	82	79	77	81	1,024	6	1,030
Thrall-Minerva	21	19	19	21	22	22	22	22	20	20	19	20	247	------	247
Webb-Zapata	130	135	122	135	140	173	141	160	164	173	134	147	1,754	32	1,786
Other	3	3	3	3	3	3	4	3	3	3	3	3	37	1	38
	2,271	2,076	2,413	2,132	2,228	2,375	4,043	5,493	7,231	9,964	9,966	5,195	55,387	789	56,176
North central Texas	3,693	3,223	3,722	3,865	4,206	4,159	3,988	3,522	3,196	3,271	3,428	3,324	43,597	299	43,896
West Texas	6	3	4	6	6	8	8	9	14	17	19	20	120	10	130
	5,970	5,302	6,139	6,003	6,440	6,542	8,039	9,024	10,441	13,252	13,413	8,539	99,104	1,098	100,202
1924															
East and south central Texas:															
Calliham	11	9	16	13	17	20	20	23	16	17	15	9	186	1	187
Corsicana-Currie-Mexia-Powell-Richland-Wortham	4,086	4,096	5,298	4,665	4,143	3,864	3,888	3,936	3,824	3,831	3,304	3,832	48,767	505	49,272
Luling	464	499	647	680	1,220	1,212	1,152	1,074	1,123	1,032	940	777	10,820	314	11,134
Somerset	100	92	100	91	98	91	94	89	87	88	86	88	1,104	5	1,109
Thrall-Minerva	19	16	19	19	20	20	21	20	21	21	19	19	234	1	235
Webb, Zapata, and Jim Hogg Counties	138	152	169	169	186	181	208	199	194	190	204	225	2,215	------	2.215
Other	4	4	3	4	5	3	8	6	6	5	6	5	59	------	59
	4,822	4,868	6,252	5,641	5,689	5,391	5,391	5,347	5,271	5,184	4,574	4,955	63,385	826	64,211
North Central Texas	3,309	3,310	3,671	3,671	3,904	3,724	3,695	3,573	3,374	3,406	3,472	3,562	42,671	−184	42,487
West Texas:															
Big Lake	2	2	4	4	8	19	62	140	109	127	264	265	1,006	50	1,056
Carson and Hutchinson Counties	------	------	------	------	------	18	28	25	43	43	30	19	206	66	272
Westbrook	14	13	13	23	29	30	31	37	47	43	47	43	370	44	414
	16	15	17	27	37	67	121	202	199	213	341	327	1,582	160	1,742
	8,147	8,193	9,940	9,339	9,630	9,182	9,207	9,122	8,844	8,803	8,387	8,844	107,638	802	108,440

Petroleum produced in Louisiana, 1914–1924, by districts

[Thousands of barrels of 42 U. S. gallons]

Year	Gulf coast (salt-dome pools)							Northern										Total for State
	Anse la Butte	Edgerley	Jennings	Lockport	Vinton	Other	Total	Bellevue	Caddo	Cotton Valley	De Soto	Elm Grove	Haynesville	Homer	Red River (Bull Bayou, Crichton)	Other	Total	
1914	19	586	412	----	1, 465	19	2, 501	-----	7, 572	-----	3, 834	----	------	------	402	----	11, 808	14, 309
1915	21	1, 403	435	----	1, 234	17	3, 110	-----	6, 472	-----	1, 797	----	------	------	6, 802	11	15, 082	18, 192
1916	13	1, 252	517	----	1, 640	4	3, 426	-----	5, 464	-----	1, 657	----	------	------	4, 691	10	11, 822	15, 248
1917	5	806	399	----	1, 595	25	2, 830	-----	5, 483	-----	1, 371	----	------	------	1, 665	43	8, 562	11, 392
1918	[a] 3	512	369	----	1, 839	15	2, 738	-----	11, 144	-----	1, 066	----	------	------	1, 046	49	13, 305	16, 043
1919	---	361	347	----	1, 592	9	2, 309	-----	[a] 8,700	-----	[a] 1,200	----	------	[a] 2, 000	[a] 2, 900	79	14, 879	17, 188
1920	---	379	232	----	1, 333	3	1, 947	-----	6, 336	-----	([b])	----	------	21, 508	[b] 5, 923	----	33, 767	35, 714
1921	47	250	254	----	1, 379	---	1, 930	-----	5, 342	-----	719	----	3, 161	13, 030	2, 844	77	25, 173	27, 103
1922	36	125	191	----	1, 395	---	1, 747	1, 050	4, 498	-----	531	160	19, 939	5, 673	1, 778	----	33, 629	35, 376
1923	18	157	204	----	2, 071	---	2, 450	2, 351	4, 178	-----	429	220	10, 496	3, 581	1, 207	7	22, 469	24, 919
1924	12	166	213	128	1, 968	---	2, 487	1, 749	4, 319	1, 211	353	217	6, 720	2, 837	1, 231	----	18, 637	21, 124

[a] Estimated

[b] De Soto included with Red River.

Petroleum produced in Louisiana, 1923–24, by districts and months

[Thousands of barrels of 42 U. S. gallons]

District	Petroleum transported from producing properties													Oil consumed on leases plus net change in producers' stocks, Jan. 1–Dec. 31	Production
	January	February	March	April	May	June	July	August	September	October	November	December	The year		
1923															
Gulf coast (salt-dome pools)															
Anse la Butte	2	2	1	1	2	1	2	2	1	1	1	1	17	1	18
Edgerley	13	10	11	13	17	11	12	10	11	11	8	8	135	22	157
Jennings	14	13	14	14	13	15	15	17	19	16	18	16	184	20	204
Vinton	156	143	173	160	164	166	162	162	163	159	154	152	1, 914	157	2, 071
	185	168	199	188	196	193	191	191	194	187	181	177	2, 250	200	2, 450
Northern															
Bellevue	170	145	204	209	195	153	205	231	191	165	124	164	2, 156	195	2, 351
Caddo	361	314	371	338	359	339	344	357	331	370	371	315	4, 170	8	4, 178
DeSoto	40	39	43	38	38	35	35	35	34	33	33	31	434	−5	429
Elm Grove	13	15	18	15	24	20	25	21	19	14	20	20	224	−4	220
Haynesville	1, 123	958	1, 107	1, 009	994	889	859	815	718	708	674	672	10, 526	−30	10, 496
Homer	345	294	330	301	317	302	303	295	286	283	258	273	3, 587	−6	3, 581
Red River (Bull Bayou, Crichton)	137	116	123	121	124	115	120	119	111	114	112	110	1, 422	−215	1, 207
Other	-----	-----	-----	-----	-----	-----	-----	-----	2	4	1	-----	7	------	7
	2, 189	1, 881	2, 196	2, 031	2, 051	1, 853	1, 891	1, 873	1, 692	1, 691	1, 593	1, 585	22, 526	−57	22, 469
	2, 374	2, 049	2, 395	2, 219	2, 247	2, 046	2, 082	2, 064	1, 886	1, 878	1, 774	1, 762	24, 776	143	24, 919

Petroleum produced in Louisiana, 1923–24, by districts and months—Continued

[Thousands of barrels of 42 U. S. gallons]

District	Petroleum transported from producing properties													Oil consumed on leases plus net change in producers' stocks, Jan. 1–Dec. 31	Production
	January	February	March	April	May	June	July	August	September	October	November	December	The year		
1924															
Gulf coast (salt-dome pools)															
Anse la Butte	1	1	2	1	1	1	1	1	-----	1	1	1	12	------	12
Edgerley	13	8	10	6	12	12	14	11	11	19	15	17	148	18	166
Jennings	14	14	15	12	14	17	14	15	20	16	16	19	186	27	213
Lockport	-----	-----	-----	-----	-----	-----	-----	-----	30	37	24	18	109	19	128
Vinton	156	145	157	144	158	163	173	164	151	189	167	169	1,936	32	1,968
	184	168	184	163	185	193	202	191	212	262	223	224	2,391	96	2,487
Northern															
Bellevue	183	158	173	172	188	159	148	138	133	133	112	101	1,798	−49	1,749
Caddo	309	297	326	374	443	406	382	372	363	356	336	344	4,308	11	4,319
Cotton Valley	1	8	15	28	33	48	122	174	172	189	246	158	1,194	17	1,211
DeSoto	31	31	30	31	31	30	30	30	29	29	25	26	353	------	353
Elm Grove	18	20	20	20	19	18	19	18	18	17	16	15	218	−1	217
Haynesville	629	568	570	516	632	602	609	585	537	522	472	466	6,708	12	6,720
Homer	254	248	256	251	252	238	240	232	217	227	213	210	2,838	−1	2,837
Red River (Bull Bayou, Crichton)	110	101	111	104	107	105	103	103	98	99	94	99	1,234	−3	1,231
	1,535	1,431	1,501	1,496	1,705	1,606	1,653	1,652	1,567	1,572	1,514	1,419	18,651	−14	18,637
	1,719	1,599	1,685	1,659	1,890	1,799	1,855	1,843	1,779	1,834	1,737	1,643	21,042	82	21,124

Petroleum produced in Arkansas, 1921–1924, by districts

[Thousands of barrels of 42 U. S. gallons]

Year	El Dorado	Irma	Smackover	Stephens	Total
1921	10,473	------------	------------	------------	10,473
1922	10,592	------------	2,107	13	12,712
1923	5,830	([a])	30,048	[a] 732	36,610
1924	4,760	450	40,000	818	46,028

[a] Irma included with Stephens.

Petroleum produced in Arkansas, 1923–24, by districts and months

[Thousands of barrels of 42 U. S. gallons]

District	Petroleum transported from producing properties													Oil consumed on leases plus net change in producers' stocks, Jan. 1-Dec. 31	Production
	January	February	March	April	May	June	July	August	September	October	November	December	The year		
1923															
El Dorado	494	418	636	619	592	517	515	476	413	407	359	350	5, 796	34	5, 830
Smackover	2, 187	1, 728	2, 429	2, 342	2, 698	2, 585	2, 371	2, 334	2, 648	2, 638	2, 335	2, 240	28, 535	1, 513	30, 048
Stephens	7	7	14	19	31	48	64	89	84	86	80	78	607	[a] 125	[a] 732
	2, 688	2, 153	3, 079	2, 980	3, 321	3, 150	2, 950	2, 899	3, 145	3, 131	2, 774	2, 668	34, 938	1, 672	36, 610
1924															
El Dorado	435	400	420	418	452	432	420	441	401	402	346	331	4, 898	−138	4, 760
Irma	-----	-----	-----	-----	-----	-----	6	14	30	37	24	21	132	318	450
Smackover	2, 334	2, 539	3, 169	3, 378	3, 935	3, 690	3, 923	3, 684	3, 318	3, 261	2, 918	2, 640	38, 789	[b]1, 211	40, 000
Stephens	65	62	69	75	83	72	71	74	62	65	60	59	817	1	818
	2, 834	3, 001	3, 658	3, 871	4, 470	4, 194	4, 420	4, 213	3, 811	3, 765	3, 348	3, 051	44, 636	1, 392	46, 028

[a] Includes Irma.

[b] Estimated in part.

Petroleum produced in Colorado, 1914–1924, by districts

[Thousands of barrels of 42 U. S. gallons]

Year	Boulder	Florence	Fort Collins	Moffat	Other	Total	Year	Boulder	Florence	Fort Collins	Moffat	Other	Total
1914	6	216	------	------	1	223	1920	7	88	------	------	[a]16	111
1915	6	202	------	------	------	208	1921	5	83	------	------	[a]20	108
1916	6	191	------	------	------	197	1922	4	70	------	------	[a]23	97
1917	6	114	------	------	1	121	1923	3. 8	62	------	------	[a]20. 2	86
1918	4	135	------	------	4	143	1924	4	70	86	256	[a]29	445
1919	5	102	------	------	[a]14	121							

[a] Rangely.

Petroleum produced in Colorado, 1923–24, by districts and months

[Thousands of barrels of 42 U. S. gallons]

District	Petroleum transported from producing properties													Oil consumed on leases plus net change in producers' stocks, Jan. 1-Dec. 31	Production
	January	February	March	April	May	June	July	August	September	October	November	December	The year		
1923															
Boulder	0.4	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.4	3.8	------	3.8
Florence	5.9	4.6	5.5	5.6	6.1	5.1	4.3	5.0	5.2	5.0	5.4	4.3	62.0	------	62.0
Rangely	.6	.7	-----	.5	2.7	2.1	2.3	2.8	2.4	2.3	2.0	1.8	20.2	------	20.2
	6.9	5.5	5.8	6.4	9.1	7.5	6.9	8.2	7.9	7.6	7.7	6.5	86.0	------	86.0
1924															
Boulder	1	2	2	2	2	4	5	4	3	3	3	2	4	------	4
Rangely													29	------	29
Florence	4	6	5	5	5	5	7	7	7	6	6	5	68	2	70
Fort Collins	-----	-----	-----	-----	-----	-----	-----	9	20	18	18	21	86	------	86
Moffat	-----	-----	-----	-----	-----	-----	35	64	46	38	37	27	247	9	256
	5	8	7	7	7	9	47	84	76	65	64	55	434	11	445

Petroleum produced in Wyoming, 1914–1924, by districts

[Thousands of barrels of 42 U. S. gallons]

Year	Big Muddy	Byron-Greybull-Torchlight	Elk Basin	Ferris	Grass Creek	Hamilton Dome-Warm Springs	Lance Creek	Lander-Dallas-Derby Dome	Lost Soldier
1914	----------	96	----------	----------	----------	----------	----------	27	----------
1915	(a)	141	----------	----------	99	----------	----------	28	----------
1916	(a)	140	721	----------	1,370	----------	----------	[b] 63	----------
1917	665	62	1,530	----------	2,756	----------	----------	[b] 50	----------
1918	3,082	45	1,067	----------	2,951	----------	----------	48	----------
1919	3,104	27	740	(c)	2,049	----------	461	62	[c] 167
1920	2,083	69	732	(c)	1,573	57	353	84	[c] 135
1921	1,927	80	681	(c)	1,435	67	346	119	[c] 524
1922	1,506	70	652	(c)	1,784	111	282	149	[c] 751
1923	1,527	57	634.4	(c)	1,589	216	363	137	[c] 1,551
1924	1,272	33	409	42	1,113	239	786	133	1,733

Year	Mule Creek	Notches	Osage	Pilot Butte	Poison Spider-South Casper	Rex Lake	Rock Creek	Salt Creek	Teapot	Other	Total
1914	--------	--------	--------	--------	--------	--------	--------	3,421	--------	16	3,560
1915	--------	--------	--------	--------	--------	--------	--------	3,971	--------	7	4,246
1916	--------	--------	--------	(b)	--------	--------	--------	3,933	--------	7	6,234
1917	--------	--------	--------	(b)	--------	--------	--------	3,911	--------	4	8,978
1918	--------	--------	--------	62	--------	--------	--------	5,337	--------	4	12,596
1919	--------	--------	--------	91	--------	--------	242	6,225	--------	4	13,172
1920	182	--------	16	69	--------	--------	1,370	10,090	--------	18	16,831
1921	68	--------	176	46	--------	--------	1,681	12,172	--------	11	19,333
1922	168	--------	182	38	--------	--------	1,728	19,248	37	9	26,715
1923	--------	61	178	29	(a)	--------	1,429	35,770	1,156	87.6	44,785
1924	178	39	146	29	229	41	1,181	30,874	1,004	17	39,498

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[a] Included under "Other."
[b] Pilot Butte included with Lander-Dallas.
[c] Ferris included with Lost Soldier.

Petroleum produced in Wyoming, 1923–24, by districts and months

[Thousands of barrels of 42 U. S. gallons]

District	Petroleum transported from producing properties													Oil consumed on leases plus net change in producers' stocks, Jan. 1–Dec. 31	Production
	January	February	March	April	May	June	July	August	September	October	November	December	The year		
1923															
Big Muddy	111	114	136	136	137	138	148	115	125	126	132	115	1,533	−6	1,527
Byron-Greybull-Torchlight	6	5	6	5	5	4	3	4	3	3	2	3	49	8	57
Elk Basin	51	42.5	49.1	56.5	59.8	57.4	56.9	58.8	55.5	53.4	47	41.5	629.4	5	634.4
Grass Creek	131	109	129	147	155	153	158	158	144	115	98	93	1,590	−1	1,589
Hamilton Dome	21		26	29		31	18	20	16	18	24	16	219	−3	216
Lance Creek	20	18	19	18	28	26	22	21	19	18	68	83	360	3	363
Lander-Dallas	12	10	14	14	13	14	12	12	16	13	13	12	155	−18	137
Lost Soldier-Ferris	62	22	36	160	181	153	166	141	123	164	200	211	1,619	−68	1,551
Osage	21	15	18	17	19	15	14	15	8	14	15	9	180	−2	178
Pilot Butte	2	2	2	3	2		1	4	2	3	1	2	27	2	29
Rock Creek	121	121	129	132	124	125	126	127	116	116	103	96	1,436	−7	1,429
Salt Creek	2,332	2,269	2,498	2,668	2,764	2,699	3,304	3,344	3,423	3,318	3,463	3,413	35,495	275	35,770
Teapot	30	28	38	42	119	123	116	124	128	138	131	120	1,137	19	1,156
Other							12.2	15	10.1	34	23.3	25	119.6	29	148.6
	2,920	2,755.5	3,100.1	3,427.5	3,606.8	3,541.4	4,157.1	4,158.8	4,188.6	4,133.4	4,320.3	4,239.5	44,549	236	44,785
1924															
Big Muddy	97	115	100	96	110	104	112	118	112	114	102	94	1,274	−2	1,272
Elk Basin	40	40	41	40	38	36	35	34	28	30	27	23	412	−3	409
Ferris	4	5	4	3	1	2	3	3	2	2	3	4	36	6	42
Grass Creek	92	85	93	106	112	91	91	92	91	93	85	68	1,099	14	1,113
Hamilton Dome		29	17	31		27	19	45	18	21	10	17	234	5	239
Lance Creek	55	63	74	60	94	87	89	68	51	39	34	30	744	42	786
Lander-Dallas-Derby Dome	10	12	13	11	13	11	10	10	10	11	10	9	130	3	133
Lost Soldier	178	146	88	80	71	124	160	222	149	168	143	190	1,719	14	1,733
Mule Creek			7	43	37	27	25	22	20				181	−3	178
Notches						3	3		10	8			24	15	39
Osage	12	10	13	14	14	12	13	13	13	12	11	9	146		146
Pilot Butte	1	2	3	2	2	2	2	2	2	3	1	2	24	5	29
Poison Spider South Casper	16	8	8	6	19	25	22	24	26	25	36	14	229		229
Rex Lake								26	4	1	2	1	34	7	41
Rock Creek	100	105	101	98	107	89	94	102	94	104	91	92	1,177	4	1,181
Salt Creek	3,510	3,076	2,980	3,202	2,815	2,667	2,697	2,614	2,273	2,043	1,715	1,538	31,130	−256	30,874
Teapot	123	108	106	94	87	83	75	69	75	66	57	61	1,004		1,004
Other	2	2	3	2	4	4	3	4	3	4	3	2	36	14	50
	4,240	3,806	3,651	3,888	3,524	3,394	3,453	3,468	2,981	2,744	2,330	2,154	39,633	−135	39,498

Petroleum produced in Montana, 1916–1924, by districts

[Thousands of barrels of 42 U. S. gallons]

Year	Cat Creek	Elk Basin	Kevin-Sunburst	Other	Total	Year	Cat Creek	Elk Basin	Kevin-Sunburst	Other	Total
1916	--------	45	--------	--------	45	1921	1,408	75	--------	26	1,509
1917	--------	100	--------	--------	100	1922	2,333	46	36	34	2,449
1918	--------	69	--------	--------	69	1923	2,227	28	523	4	2,782
1919	--------	90	--------	--------	90	1924	1,572	24	1,217	2	2,815
1920	243	97	--------	--------	340						

Petroleum produced in Montana, 1923–24, by districts and months

[Thousands of barrels of 42 U. S. gallons]

District	Petroleum transported from producing properties													Oil consumed on leases plus net change in producers' stocks, Jan. 1–Dec. 31	Production
	January	February	March	April	May	June	July	August	September	October	November	December	The year		
1923															
Cat Creek	215	180	197	199	194	167	169	164	158	157	139	148	2,087	140	2,227
Elk Basin	3	2	2	2	2	2	3	2	3	2	3	2	28	------	28
Kevin-Sunburst	18	10	16	30	10	38	80	95	97	33	8	9	444	79	523
Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	4	4
	236	192	215	231	206	207	252	261	258	192	150	159	2,559	223	2,782
1924															
Cat Creek	147	135	142	134	130	131	125	130	120	126	123	117	1,560	12	1,572
Elk Basin	3	2	3	2	2	2	2	2	2	1	1	2	24	------	24
Kevin-Sunburst	1	6	27	130	132	110	120	150	170	145	115	102	1,208	9	1,217
Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	2	2
	151	143	172	266	264	243	247	282	292	272	239	221	2,792	23	2,815

Petroleum produced in California, 1923–24, by fields

[Barrels of "clean oil," from State Mining Bureau]

Field	1923			1924		
	Jan. 1 to June 30	July 1 to Dec. 31	Total	Jan. 1 to June 30	July 1 to Dec. 31	Total
District No. 1:						
Beverly Hills	81, 838	85, 715	167, 553	76, 161	73, 285	149, 446
Brea Olinda	1, 807, 901	1, 904, 027	3, 711, 928	1, 987, 232	2, 153, 532	4, 140, 764
Coyote Hills	2, 232, 911	547, 234	2, 780, 145	1, 894, 136	3, 717, 576	5, 611, 712
Dominguez	------------	167, 836	167, 836	856, 031	5, 894, 730	6, 750, 761
Huntington Beach	17, 952, 556	15, 860, 629	33, 813, 185	9, 691, 853	7, 644, 080	17, 335, 933
Inglewood	------------	------------	------------	------------	6, 180	6, 180
Long Beach	26, 507, 886	41, 393, 116	67, 901, 002	34, 278, 304	25, 813, 487	60, 091, 791
Montebello	2, 070, 294	1, 919, 589	3, 989, 883	3, 086, 775	3, 143, 545	6, 230, 320
Newhall	31, 480	27, 456	58, 936	32, 154	40, 738	72, 892
Newport	------------	------------	------------	------------	20, 250	20, 250
Richfield	3, 283, 180	2, 886, 483	6, 169, 663	2, 381, 754	2, 194, 464	4, 576, 218
Rosecrans	------------	------------	------------	40, 607	493, 896	534, 503
Salt Lake	394, 054	400, 501	794, 555	302, 383	236, 746	539, 129
Santa Fe Springs	31, 752, 818	49, 711, 597	81, 464, 415	16, 151, 853	11, 084, 543	27, 236, 396
Torrance	592, 490	2, 563, 226	3, 155, 716	7, 550, 114	8, 819, 100	16, 369, 214
Whittier	367, 974	368, 489	736, 463	392, 721	408, 825	801, 546
	87, 075. 382	117, 835, 898	204, 911, 280	78, 722, 078	71, 744, 977	150, 467, 055
Los Angeles City field	([a])	([a])	[b] 229,069	([a])	([a])	[b] 225, 000
District No. 2:						
Bardsdale	196, 301	184, 915	381, 216	177, 612	186, 346	363, 958
Conejo	510	255	765	900	832	1, 732
Ojai	36, 225	41, 139	77, 364	41, 204	39, 827	81, 031
Piru	58, 698	59, 831	118, 529	59, 545	65, 360	124, 905
Santa Paula	19, 448	14, 121	33, 569	11, 319	14, 218	25, 537
Sespe	24, 902	21, 483	46, 385	20, 531	25, 321	45, 852
Simi	38, 824	36, 575	75, 399	34, 293	31, 520	65, 813
South Mountain	738, 554	721, 701	1, 460, 255	683, 179	719, 855	1, 403, 034
Ventura	712, 306	705, 006	1, 417, 312	801, 160	1, 044, 988	1, 846, 148
	1, 825, 768	1, 785, 026	3, 610, 794	1, 829, 743	2, 128, 267	3, 958, 010
District No. 3:						
Arroyo Grande	17, 406	15, 582	32, 988	16, 370	14, 852	31, 222
Casmalia	575, 273	505, 330	1, 080, 603	517, 414	523, 379	1, 040, 793
Cat Canyon	254, 618	281, 220	535, 838	285, 855	291, 566	577, 421
Half Moon Bay [c]	388	388	776	388	388	776
Lompoc	75, 050	40, 345	115, 395	19, 271	18, 959	38, 230
Moody Gulch	------------	------------	------------	334	338	672
Santa Maria	624, 788	653, 123	1, 277, 911	606, 821	589, 716	1, 196, 537
Sargent	7, 340	7, 160	14, 500	6, 980	6, 765	13, 745
Summerland [c]	26, 100	26, 100	52, 200	26, 100	26, 100	52, 200
	1, 580, 963	1, 529, 248	3, 110, 211	1, 479, 533	1, 472, 063	2, 951, 596
District No. 4:						
Belridge-Lost Hills-Devils Den	1, 130, 088	666, 984	1, 797, 072	636, 062	330, 100	966, 162
Elk Hills	4, 016, 230	4, 071, 319	8, 087, 549	6, 324, 018	7, 206, 216	13, 530, 234
Kern River	3, 524, 969	3, 045, 871	6, 570, 840	3, 306, 720	3, 212, 311	6, 519, 031
McKittrick-Temblor	1, 107, 872	1, 098, 859	2, 206, 731	1, 051, 607	1, 059, 784	2, 111, 391
Midway-Sunset	13, 848, 475	13, 306, 250	27, 154, 725	17, 858, 958	19, 837, 369	37, 696, 327
Wheeler Ridge	43, 706	92, 171	135, 877	161, 910	190, 350	352, 260
	23, 671, 340	22, 281, 454	45, 952, 794	29, 339, 275	31, 836, 130	61, 175, 405
District No. 5: Coalinga	2, 412, 869	2, 648, 673	5, 061, 542	5, 372, 398	4, 784, 007	10, 156, 405
Grand total	([a])	([a])	262, 875, 690	([a])	([a])	228, 933, 471

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[a] Semiannual figures for Los Angeles City field not available.
[b] Includes San Mateo County.
[c] Estimated.

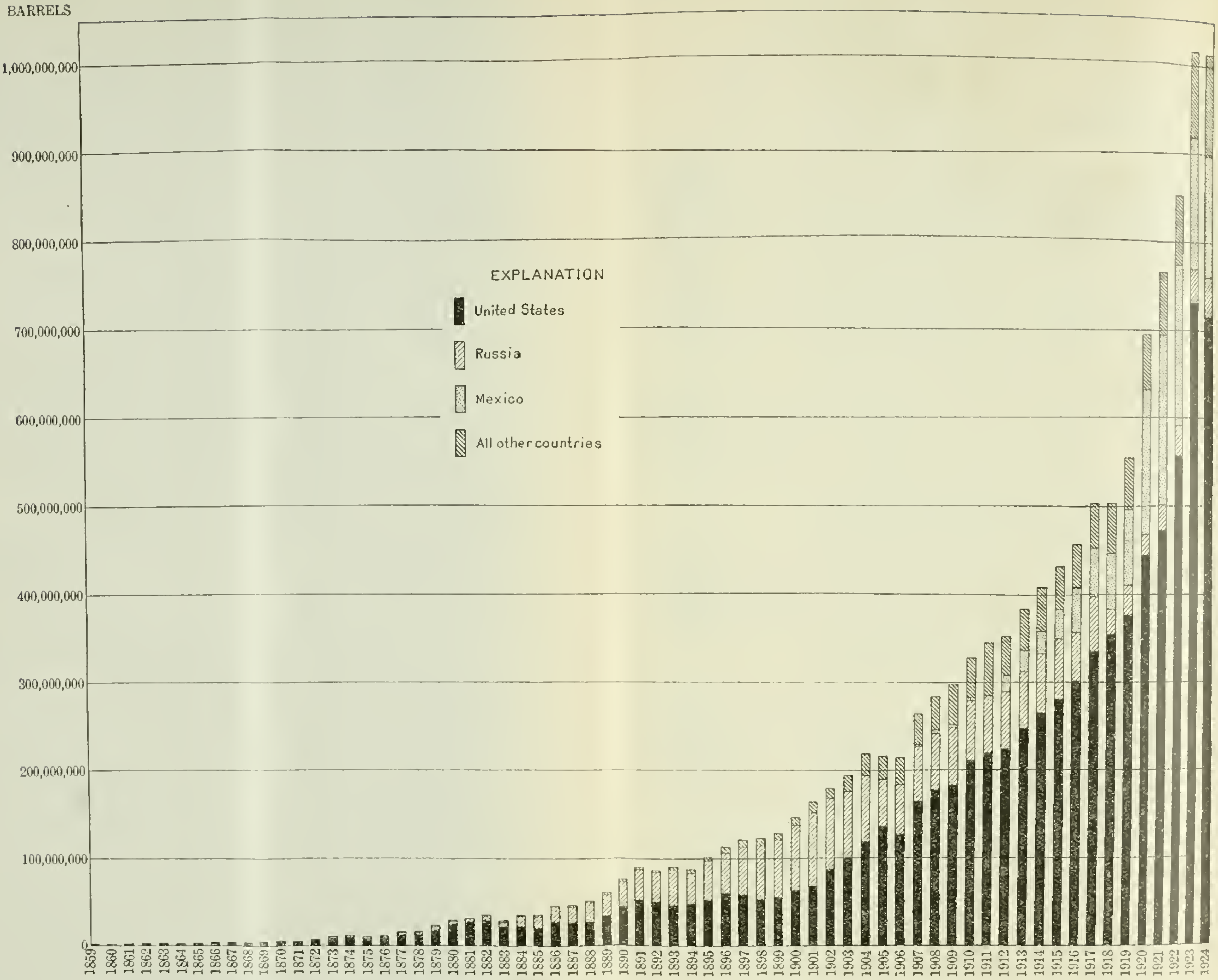

FIGURE 15.—PRODUCTION OF PETROLEUM IN THE UNITED STATES, RUSSIA, MEXICO, AND ALL OTHER COUNTRIES, 1859-1924

Petroleum produced in California, 1919–1924, by counties[a]

[Thousands of barrels of 42 U. S. gallons]

County	1919	1920	1921	1922	1923	1924
Fresno	16, 091	15, 375	12, 162	9, 266	5, 061	10, 156
Kern	47, 734	50, 660	57, 435	53, 512	45, 953	61, 175
Los Angeles	15, 077	14, 026	12, 396	37, 726	158, 665	119, 028
Orange	14, 459	15, 463	22, 929	31, 049	46, 475	31, 661
San Luis Obispo	[b] 31	[b] 43	[b] 31	[b] 34	33	31
Santa Barbara	6, 089	5, 804	5, 466	3, 931	3, 062	2, 905
Santa Clara	17	16	14	16	[b] 16	[c] 19
Ventura	1, 685	1, 990	2, 167	2, 934	3, 611	3, 958
	101, 183	103, 377	112, 600	138, 468	262, 876	228, 933

[a] California State Mining Bureau.
[b] Includes San Mateo.
[c] Includes San Mateo and San Bernardino.

WORLD'S PRODUCTION

In 1924, for the second time in the history of the industry, the world's production of petroleum exceeded 1,000,000,000 barrels. The output of 1,013,559,000 barrels in 1924, however, was about 2,000,000 barrels less than that in 1923, as the decrease in output of the United States and Mexico (28,400,000 barrels) was not entirely offset by gains in other countries. There was no change in rank for the six leading countries—United States, Mexico, Russia, Persia, Dutch East Indies, and Rumania—which produced 95 per cent of the total world's output. The most important changes in rank in 1924 were as follows: Venezuela advanced from tenth to seventh in rank, passing India, Peru, and Poland; and Argentina went from twelfth to eleventh, changing places with Sarawak (British Borneo). The main changes in production during 1924, as contrasted with 1923, expressed in percentages, are: Venezuela's production of 9,042,000 barrels is an increase of about 115 per cent; and Peru and Argentina each surpassed the preceding year's record by 37 per cent, Rumania by 22 per cent, Russia by 16 per cent, and Persia by 28 per cent. On the other hand, the production of Mexico decreased 7 per cent and that of the United States 2.5 per cent.

Figure 15 shows graphically the world's production from 1859 to 1924.

World's production of crude petroleum, 1857–1924, by years and countries

[Thousands of barrels of 42 U. S. gallons]

Year	Rumania	United States	Italy	Canada	Russia	Poland (Galicia)	Japan and Taiwan	Germany	India	Dutch East Indies	Peru	Mexico	Argentina
1857-60	19	502	(a)	------	------	------	------	------	------	------	------	------	------
1861	17	2,114	(a)	------	------	------	------	------	------	------	------	------	------
1862	23	3,057	(a)	12	------	------	------	------	------	------	------	------	------
1863	28	2,611	(a)	83	41	------	------	------	------	------	------	------	------
1864	33	2,116	(a)	90	65	------	------	------	------	------	------	------	------
1865	39	2,498	2	110	67	------	------	------	------	------	------	------	------
1866	42	3,598	1	175	83	------	------	------	------	------	------	------	------
1867	51	3,347	1	190	120	------	------	------	------	------	------	------	------
1868	56	3,646	(a)	200	88	------	------	------	------	------	------	------	------
1869	59	4,215	(a)	220	202	------	------	------	------	------	------	------	------
1870	84	5,261	(a)	250	204	------	------	------	------	------	------	------	------
1871	90	5,205	(a)	270	165	------	------	------	------	------	------	------	------
1872	91	6,293	(a)	308	185	------	------	------	------	------	------	------	------
1873	104	9,894	(a)	365	475	------	------	------	------	------	------	------	------
1874	103	10,927	1	169	583	150	------	------	------	------	------	------	------
1875	108	8,788	1	220	697	158	5	------	------	------	------	------	------
1876	111	9,133	3	312	1,321	164	7	------	------	------	------	------	------
1877	108	13,350	3	312	1,801	170	10	------	------	------	------	------	------
1878	109	15,397	4	312	2,401	176	18	------	------	------	------	------	------
1879	110	19,914	3	575	2,761	215	23	------	------	------	------	------	------
1880	115	26,286	2	350	3,001	229	26	9	------	------	------	------	------
1881	122	27,661	1	275	3,601	287	17	29	------	------	------	------	------
1882	136	30,350	2	275	4,538	330	15	58	------	------	------	------	------
1883	139	23,450	2	250	6,002	365	20	27	------	------	------	------	------
1884	211	24,218	3	250	10,805	408	28	46	------	------	------	------	------
1885	193	21,859	2	250	13,925	465	30	41	------	------	------	------	------
1886	168	28,065	2	584	18,006	306	38	74	------	------	------	------	------
1887	182	28,283	1	526	18,368	344	29	74	------	------	------	------	------
1888	219	27,612	1	695	23,049	467	37	85	------	------	------	------	------
1889	298	35,164	1	705	24,609	515	53	68	94	------	------	------	------
1890	383	45,824	3	795	28,691	659	52	108	118	------	------	------	------
1891	488	54,293	8	755	34,573	631	53	109	190	------	------	------	------
1892	593	50,515	18	780	35,775	646	69	101	242	------	------	------	------
1893	535	48,431	19	798	40,457	693	106	100	299	600	------	------	------
1894	508	49,344	21	829	36,375	949	173	123	327	688	------	------	------
1895	576	52,892	26	726	46,140	1,453	170	121	372	1,216	------	------	------
1896	543	60,960	18	727	47,221	2,444	237	145	430	1,427	47	------	------
1897	571	60,476	14	710	54,399	2,226	262	166	546	2,552	71	------	------
1898	776	55,364	15	758	61,610	2,376	319	184	542	2,964	71	------	------
1899	1,426	57,071	16	808	65,955	2,314	539	192	941	1,796	89	------	------
1900	1,629	63,621	12	913	75,780	2,347	871	358	1,079	2,253	274	------	------
1901	1,678	69,389	16	757	85,168	3,251	1,117	314	1,431	4,014	275	10	------
1902	2,060	88,767	19	531	80,540	4,142	996	354	1,617	2,430	287	40	------
1903	2,763	100,461	18	487	75,591	5,235	1,209	446	2,510	5,770	278	75	------
1904	3,599	117,081	26	553	78,537	5,947	1,219	637	3,385	6,508	290	126	------
1905	4,421	134,717	44	634	54,960	5,766	1,347	561	4,137	7,850	373	251	------
1906	6,378	126,494	54	569	58,897	5,468	1,564	579	4,016	8,181	531	502	------
1907	8,118	166,095	60	789	61,851	8,456	1,718	757	4,344	9,983	751	1,005	(a)
1908	8,252	178,527	51	528	62,187	12,612	1,871	1,009	5,047	10,283	945	3,933	12
1909	9,327	183,171	42	421	65,970	14,933	1,887	1,019	6,677	11,042	1,411	2,714	18
1910	9,724	209,557	51	316	70,337	12,673	1,829	1,032	6,138	11,031	1,258	3,634	20
1911	11,108	220,449	75	291	66,184	10,519	1,737	1,017	6,451	12,173	1,465	12,553	13
1912	12,976	222,935	54	243	68,019	8,535	1,659	1,031	7,117	10,846	1,752	16,558	47
1913	13,555	248,446	47	228	62,834	7,818	1,940	857	7,930	11,172	2,071	25,696	131
1914	12,827	265,763	40	215	67,020	6,436	2,636	781	7,410	11,422	1,837	26,235	276
1915	12,030	281,104	44	215	68,548	5,352	2,928	703	8,202	11,920	2.579	32,911	513
1916	8,945	300,767	51	198	65,817	6,587	2,963	656	8,491	12,547	2,593	40,546	867
1917	3,721	335,316	41	214	63,072	6,228	2,861	642	8,079	13,180	2,577	55,293	1,218
1918	8,730	355,928	35	305	27,168	6,032	2,441	270	8,188	12,778	2,527	63,828	1,353
1919	6,618	378,367	35	241	31,752	6,096	2,238	265	8,736	15,508	2,628	87,073	1,331
1920	7,435	442,929	35	196	25,430	5,607	2,221	246	8,375	17,529	2,817	157,069	1,651
1921	8,368	472,183	32	188	28,968	5,167	2,233	274	8,734	16,958	3,699	193,398	2,036
1922	9,843	557,531	31	179	35,692	5,227	2,055	319	8,529	17,066	5,314	182,278	2,866
1923	10,867	732,407	34	170	39,147	5,402	1,804	346	8,406	19,870	5,699	149,585	3,400
1924	13,303	713,940	45	161	45,355	5,657	1,816	406	8,416	20,473	7,812	139,678	4,669
	207,842	7,905,929	1,186	25,561	2,053,183	190,633	49,496	16,739	157,546	294,030	52,321	1,194,991	20,421

[a] Less than 1 thousand.

World's production of crude petroleum, 1857–1924, by years and countries—Con.

[Thousands of barrels of 42 U. S. gallons]

Year	Trinidad	Egypt	Persia	Sarawak	Algeria	Venezuela	France	England	Czechoslovakia	Colombia	Other countries	Total	Percentage produced by United States
1857–60	------	------	------	------	------	------	------	------	------	------	------	521	96
1861	------	------	------	------	------	------	------	------	------	------	------	2, 131	99
1862	------	------	------	------	------	------	------	------	------	------	------	3, 092	99
1863	------	------	------	------	------	------	------	------	------	------	------	2, 763	94
1864	------	------	------	------	------	------	------	------	------	------	------	2, 304	92
1865	------	------	------	------	------	------	------	------	------	------	------	2, 716	92
1866	------	------	------	------	------	------	------	------	------	------	------	3, 899	92
1867	------	------	------	------	------	------	------	------	------	------	------	3, 709	90
1868	------	------	------	------	------	------	------	------	------	------	------	3, 990	91
1869	------	------	------	------	------	------	------	------	------	------	------	4, 696	90
1870	------	------	------	------	------	------	------	------	------	------	------	5, 799	91
1871	------	------	------	------	------	------	------	------	------	------	------	5, 730	91
1872	------	------	------	------	------	------	------	------	------	------	------	6, 877	92
1873	------	------	------	------	------	------	------	------	------	------	------	10, 838	91
1874	------	------	------	------	------	------	------	------	------	------	------	11, 933	92
1875	------	------	------	------	------	------	------	------	------	------	------	9, 977	88
1876	------	------	------	------	------	------	------	------	------	------	------	11, 051	83
1877	------	------	------	------	------	------	------	------	------	------	------	15, 754	85
1878	------	------	------	------	------	------	------	------	------	------	------	18, 417	84
1879	------	------	------	------	------	------	------	------	------	------	------	23, 601	84
1880	------	------	------	------	------	------	------	------	------	------	------	30, 018	88
1881	------	------	------	------	------	------	------	------	------	------	------	31, 993	86
1882	------	------	------	------	------	------	------	------	------	------	------	35, 704	85
1883	------	------	------	------	------	------	------	------	------	------	------	30, 255	78
1884	------	------	------	------	------	------	------	------	------	------	------	35, 969	67
1885	------	------	------	------	------	------	------	------	------	------	------	36, 765	59
1886	------	------	------	------	------	------	------	------	------	------	------	47, 243	59
1887	------	------	------	------	------	------	------	------	------	------	------	47, 807	59
1888	------	------	------	------	------	------	------	------	------	------	------	52, 165	53
1889	------	------	------	------	------	------	------	------	------	------	------	61, 507	57
1890	------	------	------	------	------	------	------	------	------	------	------	76, 633	60
1891	------	------	------	------	------	------	------	------	------	------	------	91, 100	60
1892	------	------	------	------	------	------	------	------	------	------	------	88, 739	57
1893	------	------	------	------	------	------	------	------	------	------	------	92, 038	53
1894	------	------	------	------	------	------	------	------	------	------	------	89, 337	55
1895	------	------	------	------	------	------	------	------	------	------	------	103, 692	51
1896	------	------	------	------	------	------	------	------	------	------	------	114, 199	53
1897	------	------	------	------	------	------	------	------	------	------	------	121, 993	50
1898	------	------	------	------	------	------	------	------	------	------	------	124, 979	44
1899	------	------	------	------	------	------	------	------	------	------	------	131, 147	44
1900	------	------	------	------	------	------	------	------	------	------	------	149, 137	43
1901	------	------	------	------	------	------	------	------	------	------	[b] 20	167, 440	41
1902	------	------	------	------	------	------	------	------	------	------	[b] 26	181, 809	49
1903	------	------	------	------	------	------	------	------	------	------	[b] 36	194, 879	52
1904	------	------	------	------	------	------	------	------	------	------	[b] 40	217, 948	54
1905	------	------	------	------	------	------	------	------	------	------	[b] 30	215, 091	63
1906	------	------	------	------	------	------	------	------	------	------	[b] 30	213, 263	59
1907	------	------	------	------	------	------	------	------	------	------	[b] 30	263, 957	63
1908	([a])	------	------	------	------	------	------	------	------	------	[b] 30	285, 287	63
1909	57	------	------	------	------	------	------	------	------	------	[b] 20	298, 709	61
1910	143	------	------	------	------	------	------	------	------	------	[b] 20	327, 763	64
1911	285	21	------	------	------	------	------	------	------	------	[b] 20	344, 361	64
1912	437	214	------	------	------	------	------	------	------	------	[b] 20	352, 443	63
1913	504	98	1, 857	141	------	------	------	------	------	------	[b] 20	385, 345	64
1914	644	753	2, 910	318	1	------	------	------	------	------	[b] 20	407, 544	65
1915	750	212	3, 616	392	4	------	------	------	------	------	[b] 10	432, 033	65
1916	929	404	4, 477	629	8	------	------	------	------	------	[b] 25	457, 500	66
1917	1, 602	943	7, 147	542	9	120	------	------	------	------	[c] 19	502, 824	67
1918	2, 082	1, 935	8, 623	504	7	333	[d] 363	------	------	------	------	503, 430	71
1919	1, 841	1, 517	10, 139	596	5	425	334	2	48	------	------	555, 795	68
1920	2, 083	1, 042	12, 230	1, 020	4	457	356	3	69	------	------	688, 804	64
1921	2, 354	1, 255	16, 673	1, 411	3	1, 433	389	3	94	------	[e] 50	765, 903	62
1922	2, 445	1, 188	22, 247	2, 849	9	2, 201	496	1	120	323	[b] 100	858, 909	65
1923	3, 051	1, 054	25, 230	3, 940	9	4, 201	494	1	74	424	[b] 112	1, 015, 727	72
1924	4, 057	1, 122	32, 373	4, 163	11	9, 042	426	2	76	445	[b] 111	1, 013, 559	70
	23, 264	11, 758	147, 522	16, 505	70	18, 212	2, 858	12	481	1, 192	789	12, 392, 541	64

[a] Less than 1 thousand.
[b] Estimated.
[c] Cuba.
[d] Production in previous years credited to Germany.
[e] Ecuador.

World's production of petroleum in 1924, and total production, 1857–1924 [a]

Country	1924				1857–1924			
	Thousands of barrels of 42 U. S. gallons	Thousands of metric tons	Thousands of cubic meters	Percentage of total by volume	Thousands of barrels of 42 U. S. gallons	Thousands of metric tons	Thousands of cubic meters	Percentage of total by volume
United States	713, 940	98, 024	113, 504	70. 4	7, 905, 929	1, 083, 219	1, 256, 905	63. 8
Mexico	139, 678	21, 367	22, 206	13. 8	1, 194, 991	179, 437	189, 982	9. 6
Russia	45, 355	6, 301	7, 211	4. 5	2, 053, 183	272, 620	326, 419	16. 6
Persia	32, 373	4, 313	5, 147	3. 2	147, 522	19, 663	23, 454	1. 2
Dutch East Indies	20, 473	2, 926	3, 255	2. 0	294, 030	40, 256	46, 746	2. 4
Rumania	13, 303	1, 851	2, 115	1. 3	207, 842	9, 153	33, 043	1. 7
Venezuela	9, 042	1, 335	1, 438	. 9	18, 212	2, 730	2, 896	. 1
India	8, 416	1, 182	1, 338	. 8	157, 546	21, 184	25, 046	1. 3
Peru	7, 812	1, 029	1, 242	. 8	52, 321	6, 939	8, 318	. 4
Poland	5, 657	771	899	. 5	190, 633	26, 342	30, 307	1. 5
Argentina	4, 669	679	742	. 5	20, 421	2, 978	3, 247	1. 4
British Borneo (Sarawak)	4, 163	599	662	. 4	16, 505	2, 375	2, 624	
Trinidad	4, 057	564	645	. 4	23, 264	3, 235	3, 699	
Japan and Taiwan (Formosa)	1, 816	252	289	. 2	49, 496	6, 874	7, 869	
Egypt	1, 122	163	178	. 3	11, 758	1, 694	1, 869	
Colombia	445	64	71		1, 192	171	190	
France	426	61	68		2, 858	405	455	
Germany	406	59	65		16, 739	2, 263	2, 661	
Canada	161	22	26		25, 561	3, 410	4, 064	
Czechoslovakia	76	11	12		481	71	76	
Italy	45	5	7		1, 186	167	189	
Algeria	11	18	20		70	10	11	
Barbados	10				(b)	110	126	
Cuba	4				(b)			
England	2				12			
Other	[c] 97				789			
	1, 013, 559	141, 596	161, 140	100. 0	12, 392, 541	1, 705, 306	1, 970, 196	100. 0

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[a] Compiled by L. M. Jones, of the Bureau of Mines.
[b] Included under "Other."
[c] Estimated.

Petroleum produced in Mexico in 1924, by fields

Field	Barrels
Heavy oil:	
Ebano	6, 602, 600
El Limón	10, 014
Molino	528
Panuco—	
Cacalilao	69, 180, 597
Other	23, 534, 349
San Jeronimo	90, 155
Topila	1, 155, 794
	100, 574, 037
Light oil:	
Alazán	249, 210
Cerro Viejo	135, 820
Chiconcillo y San Miguel	260, 312
Dos Bocas	7, 120
Filisola	43, 099
Furbero	72, 480
Isleta de Capoacan	2, 472
Potrero del Llano	455, 704
Sarlat	82
Tantoyuca	1, 893
Light oil—Con.	
Tepetate, Chinampa, Amatlan, Zacamixtle	10, 863, 289
Tierra Amarilla	27, 531
Tierra Blanca, Chapapote, Alamo	14, 672, 998
Toteco, Cerro Azul	12, 312, 247
	39, 104, 257
	139, 678, 294

Petroleum produced in Russia in 1924, by fields

Field	Metric tons	Barrels
Baku:		
Balakhani	611,130	4,137,961
Bibi-Eibat	778,102	5,636,571
Binagadi	213,614	1,465,606
Ramani	447,431	3,302,041
Sabunchi	1,230,223	8,562,352
Surakhani	939,893	7,499,406
Undistributed	93,514	654,785
	4,313,907	31,258,722
Emba-Ural	139,883	945,050
Ferghana	16,622	121,806
Grozny	1,768,454	12,605,540
Kuban-Black Sea	61,991	424,328
	6,300,857	45,355,446

Petroleum produced in Dutch East Indies in 1924, by fields

Borneo	1,997,153	13,502,751
Ceram	47,722	331,668
Java	302,942	2,194,512
Sumatra	577,951	4,444,443
	2,925,768	20,473,374

Petroleum produced in Poland in 1924, by fields

Drohobycz	673,176	4,933,034
Jaslo	57,125	423,696
Stanislaw	40,495	300,351
	770,796	5,657,081

IMPORTS AND EXPORTS OF CRUDE PETROLEUM

The statistics of imports and exports and of shipments to Territories, given in this report, unless otherwise specified, have been compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce. Data for refined products of petroleum are given with refinery statistics on page 455.

Imports of crude petroleum in 1924 amounted to about 77,775,000 barrels, a decrease of 4,240,000 barrels as compared with 1923 importations. As in previous years, the great bulk of oil imports was from Mexico, from which we received about 73,979,000 barrels. Although imports of Mexican crude oil decreased, reflecting the smaller output in that country, imports of crude oil into the United States from Peru and Venezuela, though relatively small, increased notably during 1924, following the large production in those countries. Exports of crude petroleum (domestic and foreign) in 1924 were nearly 17,973,000 barrels, an increase of 587,000 barrels over 1923. Of these exportations about 10,992,000 barrels were sent to Canada.

Crude petroleum imported, exported, and shipped to Territories, 1920–1924

Year	Imports		Exports (including foreign crude oil)		Shipments from United States to Territories					
					Alaska		Hawaii		Porto Rico	
	Barrels	Value	Barrels	Value	Barrels	Value	Barrels	Value	Barrels	Value
1920	106, 175, 289	$55,799,254	8, 757, 092	$29,986,874	447	$2, 838	537, 116	$1, 083, 954	124	$746
1921	125, 363, 983	66,547,379	8, 939, 633	20,261,898	--------	--------	687, 173	1, 393, 831	6	50
1922	127, 308, 423	70,383,309	10, 162, 817	18,422,231	--------	--------	641, 721	1, 060, 445	233	1, 343
1923	82, 015, 025	53,882,259	17, 385, 378	23,262,190	2, 741	13, 713	146, 482	161, 198	--------	--------
1924	77, 775, 173	73,841,507	17, 972, 539	26,660,412	204	1, 008	265, 600	275, 600	179	1, 060

Crude petroleum imported and exported, 1923–24, by months

[Thousands of barrels of 42 U. S. gallons]

	January	February	March	April	May	June	July	August	September	October	November	December	The year	
													Thousands of barrels	Value (thousands of dollars)
1923														
Imports:														
By countries—														
Canada	-----	1	-----	71	-----	-----	-----	-----	-----	-----	-----	-----	72	64
Dutch West Indies [a]	156	-----	78	76	-----	-----	74	68	-----	144	-----	214	810	880
Mexico	6, 540	6, 198	7, 289	6, 391	5, 929	5, 996	6, 771	7, 341	6, 021	6, 681	6, 085	8, 112	79, 354	51, 708
Peru	611	-----	532	79	-----	-----	70	171	-----	-----	-----	91	1, 554	1, 073
Other countries	-----	-----	159	-----	66	-----	-----	-----	-----	-----	-----	-----	225	157
	7, 307	6, 199	8, 058	6, 617	5, 995	5, 996	6, 915	7, 580	6, 021	6, 825	6, 085	8, 417	82, 015	53. 882
By ports of entry—														
Atlantic coast	4, 350	3, 133	3, 957	3, 207	2, 653	2, 920	3, 739	3, 810	2, 777	3, 820	2, 780	3, 865	41, 011	27, 953
Gulf coast	2, 957	3, 035	4, 054	3, 409	3, 250	3, 076	3, 176	3, 770	3, 244	3, 005	3, 305	4, 552	40, 833	25, 832
Pacific coast	-----	1	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	2	5
Mexican border	-----	30	47	-----	92	-----	-----	-----	-----	-----	-----	-----	169	92
	7, 307	6, 199	8, 058	6. 617	5, 995	5, 996	6, 915	7, 580	6, 021	6, 825	6, 085	8, 417	82, 015	53, 882
Exports:														
Domestic crude oil—														
Argentina	58	-----	92	70	-----	155	80	60	90	90	120	103	918	1, 014
Canada	644	410	611	818	717	1, 033	583	734	795	830	662	989	8, 826	12, 990
Cuba	-----	-----	-----	-----	27	-----	-----	56	55	62	69	64	333	855
England	-----	50	-----	50	-----	72	61	-----	-----	-----	-----	-----	233	408
Germany	-----	59	-----	93	-----	61	29	12	78	-----	-----	-----	332	679
Japan	-----	-----	52	64	64	60	63	53	64	-----	124	-----	544	545
Mexico	17	113	249	384	495	927	375	492	424	190	388	817	4, 871	4, 618
Panama	29	-----	-----	-----	-----	70	79	21	55	-----	-----	55	309	340
Peru	-----	-----	-----	-----	-----	-----	85	77	-----	90	-----	-----	252	252
Other countries	-----	4	-----	-----	3	195	163	6	-----	30	1	41	443	1, 411
Foreign crude oil	14	30	24	32	18	25	29	31	31	23	33	34	324	150
	762	666	1, 028	1, 511	1, 324	2, 598	1, 547	1, 542	1, 592	1, 315	1, 397	2, 103	17, 385	23, 262
Excess of imports over exports	6, 545	5, 533	7, 030	5, 106	4, 671	3, 398	5, 368	6, 038	4, 429	5, 510	4, 688	6, 314	64, 630	30, 620

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[a] Mostly Venezuela oil reexported from Curacoa,

Crude petroleum imported and exported, 1923–24, by months—Continued

[Thousands of barrels of 42 U. S. gallons]

	January	February	March	April	May	June	July	August	September	October	November	December	The year: Thousands of barrels	The year: Value (thousands of dollars)
1924														
Imports:														
By countries—														
Dutch West Indies [a]	55	-----	78	55	60	63	264	80	235	219	77	-----	1,186	1,509
Mexico	6,248	6,511	8,315	6,988	6,718	6,206	5,900	5,324	4,902	4,653	6,373	5,841	73,979	66,573
Peru	-----	-----	238	193	615	331	338	358	217	-----	139	-----	2,429	5,624
Other countries	-----	-----	-----	61	-----	60	-----	-----	-----	-----	60	-----	181	136
	6,303	6,511	8,631	7,297	7,393	6,660	6,502	5,762	5,354	4,872	6,649	5,841	77,775	73,842
By ports of entry—														
Atlantic coast	2,861	2,679	4,132	3,876	4,415	3,622	3,905	2,770	2,517	2,433	4,191	3,534	40,935	42,119
Gulf coast	3,442	3,832	4,499	3,421	2,978	3,038	2,597	2,992	2,837	2,439	2,458	2,307	36,840	31,723
	6,303	6,511	8,631	7,297	7,393	6,660	6,502	5,762	5,354	4,872	6,649	5,841	77,775	73,842
Exports:														
Domestic crude oil—														
Argentina	100	103	-----	90	166	87	-----	105	225	187	110	68	1,241	1,320
Canada	678	917	973	1,242	1,195	1,125	813	907	859	887	910	486	10,992	16,484
Cuba	148	53	107	124	72	109	53	105	53	106	54	152	1,136	3,002
Dutch West Indies	73	-----	-----	-----	-----	-----	-----	-----	53	-----	-----	-----	126	317
England	-----	50	80	1	-----	-----	154	-----	128	42	-----	65	520	772
Germany	-----	93	-----	-----	81	-----	-----	-----	67	22	20	68	351	809
Italy	-----	67	-----	-----	-----	-----	-----	23	-----	-----	29	-----	119	240
Japan	65	63	63	56	62	192	62	-----	75	129	70	-----	837	1,131
Mexico	414	268	194	7	246	4	287	65	141	3	131	124	1,884	1,768
Other countries	2	37	33	-----	1	-----	-----	-----	214	-----	112	-----	399	652
Foreign crude oil	48	29	35	27	27	25	40	37	20	47	17	16	368	165
	1,528	1,680	1,485	1,547	1,850	1,542	1,409	1,242	1,835	1,423	1,453	979	17,973	26,660
Excess of imports over exports	4,775	4,831	7,146	5,750	5,543	5,118	5,093	4,520	3,519	3,449	5,196	4,862	59,802	47,182

[a] Mostly Venezuela oil reexported from Curacoa.

CALIFORNIA SHIPMENTS THROUGH PANAMA CANAL

California oil shipped through Panama Canal to eastern ports in the United States, 1923–24, by months [a]

[Compiled from declarations by masters of vessels reported in long tons, 2,240 pounds]

	January	February	March	April	May	June	July	August	September	October	November	December	The year
1923													
Crude oil:													
Thousands of long tons	135	238	441	603	695	622	757	757	840	702	725	743	7,258
Thousands of barrels	985	1,740	3,222	4,398	5,075	4,542	5,524	5,525	6,135	5,125	5,290	5,422	52,983
Refined products: Thousands of long tons	-----	10	47	63	54	68	44	24	27	30	29	63	459
1924													
Crude oil:													
Thousands of long tons	692	634	608	403	497	444	393	347	487	336	286	331	5,458
Thousands of barrels	5,055	4,631	4,438	2,939	3,631	3,240	2,865	2,534	3,554	2,456	2,087	2,417	39,847
Refined products: Thousands of long tons	44	41	30	56	39	53	50	149	44	61	30	83	680

[a] From the Panama Canal Record.

STOCKS

In this report stocks of crude petroleum are classified as follows:

1. Producers' stocks, or petroleum held "at the wells" on the producing properties. Producers' stocks are reported annually.
2. Pipe-line and tank-farm stocks, or petroleum that has been transported from the producing properties but has not been delivered

at refineries or other points of consumption. For the States east of California such stocks are reported monthly as gross stocks, including the total contents of tanks and pipe lines, and as net stocks, which are gross stocks minus sediment and water. The stocks reported for California are compiled by the Pacfic coast office of the American Petroleum Institute and include producers', pipe-line, and tank-farm stocks (but not refinery stocks) of crude oil, residuum, and tops.

3. Refinery and other consumers' stocks, or petroleum that has been delivered at refineries and at other points of consumption. Stocks of crude petroleum held at refineries are reported monthly. Data concerning stocks of petroleum held by other consumers are not available.

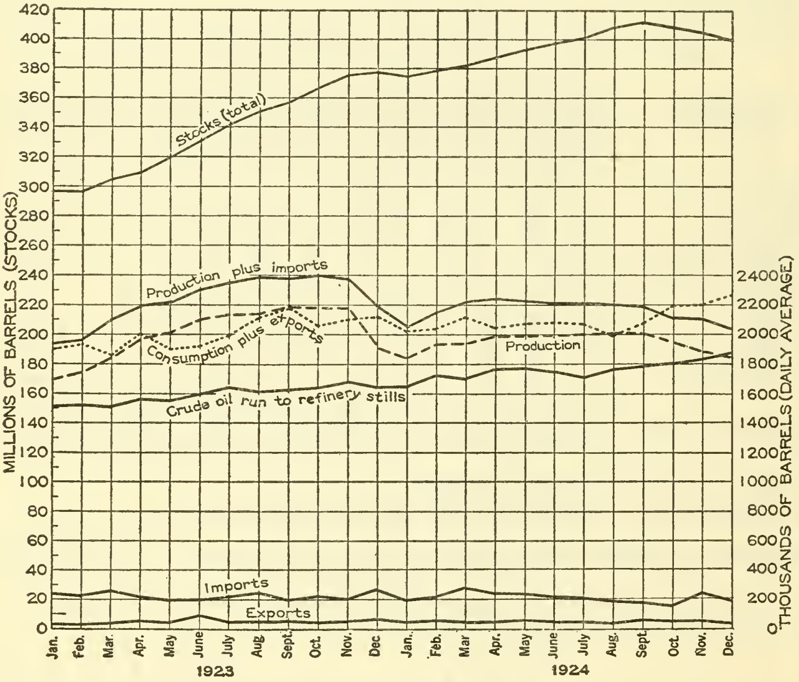

FIGURE 16.—Daily average production, imports, exports, consumption, and runs to stills and total stocks of crude petroleum at end of each month, 1923–24

The great increase in stocks of crude oil during the past few years has resulted from and is indicative of oversupply in the United States. At the end of 1918, just after the drain on stored reserves during the war, stocks of crude oil, including stocks at refineries, were reduced to 144,336,000 barrels. In spite of increasing consumption, however, there has been a pronounced oversupply of petroleum in the United States since 1920, and on December 31, 1924, total stocks of crude oil, including stocks at refineries, had increased to the record quantity of 399,792,000 barrels. In 1924, however, stocks only increased about 25,000,000 barrels, as contrasted with increases of more than 80,000,000 barrels in both the preceding two years. Stocks of liquid refined products held at refineries increased from 35,127,000 barrels on December 31, 1918, to 85,611,000 barrels on the last day of 1924.

Stocks of crude petroleum held in the United States at end of each month, 1923–24

[Thousands of barrels of 42 U. S. gallons]

		January	February	March	April	May	June	July	August	September	October	November	December
1923													
Pipe-line and tank-farm stocks:													
Domestic petroleum, by fields of origin—													
East of California—													
Appalachian—													
New York, Pennsylvania, West Virginia, eastern and central Ohio	Gross	6, 232	6, 360	6, 523	6, 337	6, 231	6, 313	6, 426	6, 472	6, 443	6, 611	6, 560	6, 606
	Net	5, 972	6, 102	6, 264	6, 079	5, 973	6, 053	6, 165	6, 262	6, 150	6, 333	6, 284	6, 331
Kentucky	Gross	3, 120	3, 092	3, 202	3, 205	3, 220	3, 255	3, 135	3, 170	3, 193	3, 144	3, 074	3, 007
	Net	3, 004	2, 979	3, 081	3, 083	3, 096	3, 128	3, 005	3, 041	3, 063	3, 011	2, 945	2, 879
Lima-Indiana	Gross	989	988	1, 011	1, 016	1, 036	1, 053	1, 065	1, 082	1, 097	1, 137	1, 166	1, 211
	Net	732	729	763	768	788	806	816	845	861	901	930	975
Illinois-southwestern Indiana	Gross	10, 720	10, 722	10, 939	11, 041	11, 212	11, 176	11, 328	11, 532	11, 726	11, 942	11, 905	11, 528
	Net	10, 218	10, 220	10, 436	10, 580	10, 751	10, 714	10, 867	11, 072	11, 290	11, 494	11, 459	11, 091
Mid-Continent—													
Oklahoma, Kansas, central and north Texas	Gross	146, 868	146, 488	147, 029	151, 425	156, 596	162, 147	165, 836	166, 248	172, 811	177, 146	182, 928	183, 052
	Net	136, 183	135, 576	136, 755	140, 258	145, 349	150, 792	154, 464	155, 172	161, 687	165, 849	171, 836	171, 781
North Louisiana and Arkansas	Gross	18, 968	19, 994	21, 327	22, 015	24, 231	26, 492	28, 287	28, 067	29, 580	30, 487	31, 762	32, 927
	Net	18, 276	19, 267	20, 467	21, 204	23, 362	25, 585	27, 359	27, 135	28, 061	28, 917	29, 101	31, 123
Gulf coast	Gross	25, 992	24, 491	23, 946	23, 668	23, 931	24, 017	23, 942	24, 314	24, 637	24, 950	25, 077	24, 355
	Net	24, 865	24, 090	23, 615	23, 290	23, 547	23, 631	23, 565	23, 942	24, 227	24, 602	24, 726	23, 974
Rocky Mountain	Gross	[a] 5, 173	5, 548	6, 381	7, 214	8, 202	9, 132	10, 080	12, 392	14, 217	15, 836	17, 987	19, 718
	Net	[a] 5, 154	5, 529	6, 376	7, 214	8, 201	9, 128	10, 077	12, 387	14, 207	15, 826	17, 977	19, 704
Total east of California	Gross	218, 062	217, 683	220, 358	225, 921	234, 659	243, 585	250, 099	253, 277	263, 704	271, 253	280, 459	282, 404
	Net	204, 404	204, 492	207, 757	212, 476	221, 067	229, 837	236, 318	239, 856	249, 546	256, 933	265, 258	267, 858
California [b]		49, 516	52, 085	53, 036	53, 720	54, 258	56, 428	59, 047	63, 240	60, 941	62, 668	63, 423	62, 162
Foreign petroleum held in the United States by importers elsewhere than at refineries—													
At Atlantic coast stations	Crude	308	290	265	235	154	217	176	174	170	230	318	324
	Topped [c]	2, 790	2, 805	2, 776	2, 750	2, 700	2, 650	2, 600	2, 340	2, 433	2, 551	2, 604	2, 806
At Gulf coast stations	Crude	340	423	447	374	493	520	627	819	750	772	789	1, 059
	Topped [c]	839	622	618	600	600	600	600	671	653	635	495	565
		4, 277	4, 140	4, 106	3, 959	3, 947	3, 987	4, 003	4, 004	4, 006	4, 188	4, 206	4, 754
Total domestic net pipe-line and tank-farm stocks east of California, California stocks, and foreign stocks (as stated above)		258, 197	260, 717	264, 899	270, 155	279, 272	290, 252	299, 368	307, 100	314, 493	323, 789	332, 887	334, 774

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[a] Includes 3,167,000 barrels formerly classed as refinery stocks.

[b] Producers', pipe-line, and tank-farm stocks of crude oil, residuum, and tops (American Petroleum Institute).

[c] Topped oil topped in Mexico.

Stocks of crude petroleum held in the United States at end of each month, 1923–24—Continued

[Thousands of barrels of 42 U. S. gallons]

		January	February	March	April	May	June	July	August	September	October	November	December
1923—Continued													
Refinery stocks (held at refineries):													
Domestic crude oil—													
East of California		16,354	16,016	19,296	20,410	21,678	22,539	24,934	25,099	22,119	23,348	23,955	24,213
California		3,286	3,178	3,366	2,944	3,113	2,844	2,833	3,799	6,409	6,647	6,198	5,543
Foreign crude oil		10,274	8,919	8,471	7,989	6,720	6,335	5,814	5,373	4,225	3,674	2,859	3,502
Total crude oil at refineries		29,914	28,113	31,133	31,343	31,511	31,718	33,581	34,271	32,753	33,669	33,012	33,259
Producers' stocks (at wells) [b]		8,549	8,658	8,779	8,897	9,017	9,135	9,255	9,375	9,493	9,613	9,731	9,850
Total crude stocks		296,660	297,488	304,811	310,395	319,800	331,105	342,204	350,746	356,739	367,071	375,630	377,883
1924													
Pipe-line and tank-farm stocks:													
Domestic petroleum, by fields of origin—													
East of California—													
Appalachian—													
New York, Pennsylvania, West Virginia, eastern and central Ohio	Gross	6,791	6,699	6,556	6,377	6,581	6,495	6,846	6,796	7,027	7,197	7,233	7,261
	Net	6,516	6,424	6,282	6,103	6,312	6,225	6,586	6,566	6,769	6,938	6,981	7,020
Kentucky	Gross	2,969	2,818	2,677	2,635	2,658	2,719	2,743	2,645	2,543	2,528	2,521	2,388
	Net	2,847	2,696	2,549	2,505	2,527	2,593	2,621	2,533	2,414	2,400	2,398	2,266
Lima-Indiana	Gross	1,152	1,163	1,209	1,215	1,246	1,294	1,349	1,393	1,438	1,468	1,433	1,431
	Net	917	927	973	986	1,017	1,064	1,124	1,169	1,227	1,253	1,218	1,221
Illinois-southwestern Indiana	Gross	11,519	11,456	11,467	11,310	11,513	11,463	11,537	11,770	11,845	11,762	11,562	11,401
	Net	11,071	10,998	11,009	10,843	11,016	10,966	11,040	11,268	11,314	11,231	11,031	10,870
Mid-Continent—													
Oklahoma, Kansas, north, central, and western Texas	Gross	180,142	179,590	178,990	180,800	182,133	185,663	187,920	192,193	193,983	194,037	192,574	187,884
	Net	168,898	168,177	167,406	169,327	170,449	173,934	176,433	180,667	182,061	182,862	181,489	176,754
North Louisiana and Arkansas	Gross	33,766	33,890	35,150	36,980	38,506	39,592	39,049	38,355	37,563	37,945	36,793	36,047
	Net	31,882	31,993	32,696	34,896	36,329	37,392	36,931	36,213	35,447	35,808	34,756	33,804
Gulf coast	Gross	23,936	24,004	23,290	22,610	22,334	20,757	21,415	21,509	21,665	21,524	21,112	20,565
	Net	23,532	23,591	22,865	22,174	21,901	20,357	21,016	21,084	21,253	21,115	20,729	20,200
Rocky Mountain	Gross	21,449	22,892	23,957	25,373	26,369	27,269	28,246	29,711	29,836	29,266	28,969	28,711
	Net	21,423	22,875	23,939	25,360	26,356	27,257	28,224	29,685	29,810	29,242	28,931	28,672
Total east of California	Gross	281,724	282,512	283,296	287,300	291,340	295,252	299,105	304,372	305,900	305,727	302,197	295,688
	Net	267,086	267,681	267,719	272,194	275,907	279,788	283,975	289,185	290,295	290,849	287,533	280,807
California [a]		63,314	63,151	64,986	65,045	66,154	66,463	67,181	68,007	70,104	68,640	69,226	68,867

Foreign crude petroleum held in United States by importers elsewhere than at refineries—												
At Atlantic coast stations	239	145	241	312	358	251	215	297	264	128	202	199
At Gulf coast stations	957	1,013	1,038	1,069	978	913	1,003	796	555	461	572	535
	1,196	1,158	1,279	1,381	1,336	1,164	1,218	1,093	819	589	774	734
Total domestic net pipe-line and tank-farm stocks east of California, California stocks, and foreign crude stocks (as stated above)	331,596	331,990	333,984	338,620	343,397	347,415	352,374	358,285	361,218	360,078	357,533	350,408
Refinery stocks (held at refineries):												
Domestic crude oil—												
East of California	24,393	26,537	28,266	28,865	29,358	29,112	29,109	29,602	29,434	28,442	28,559	27,890
California	6,070	6,332	5,779	5,636	5,774	6,246	6,616	7,305	8,357	9,192	8,852	9,811
Foreign crude oil	3,630	4,305	4,705	5,510	5,369	5,142	4,245	3,729	3,758	2,685	2,993	3,294
Total crude oil at refineries	34,093	37,174	38,750	40,011	40,501	40,500	39,970	40,636	41,549	40,319	40,404	40,995
Producers' stocks (at wells) [b]	9,726	9,610	9,486	9,367	9,243	9,124	9,000	8,876	8,757	8,633	8,513	8,389
Total crude stocks	375,415	378,774	382,220	387,998	393,141	397,039	401,344	407,797	411,524	409,030	406,450	399,792

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[a] Producers', pipe-line, and tank-farm stocks of crude oil, residuum, and tops (American Petroleum Institute).

[b] Exclusive of California. Figures for December based on reports from companies. Other months prorated.

CONSUMPTION

The relation between supply and demand for crude petroleum and the rates of annual change for 1918 to 1924 are shown in the following table (See also fig. 16, p. 422, and fig. 17, p. 427).

Comparison of annual change in supply and demand for crude petroleum, 1918–1924

Year	New supply (production plus imports)		Total supply (new supply plus stocks at beginning of year)		Indicated total demand (domestic demand plus exports)	
	Thousands of barrels	Percentage of increase or decrease	Thousands of barrels	Percentage of increase	Thousands of barrels	Percentage of increase or decrease
1918	393, 664	+7. 7	553, 116	1. 5	417, 174	+9. 1
1919	431, 189	+9. 5	559, 775	1. 2	426. 481	+2. 2
1920	549, 104	+27. 3	685, 317	22. 4	539, 289	+26. 5
1921	597, 547	+8. 8	[a] 743, 575 725, 734	8. 5	534, 972	−. 8
1922	684, 839	+14. 6	875, 601	20. 7	602, 595	+12. 6
1923	814, 422	+18. 9	[a] 1, 087, 428 1, 110, 130	24. 2	732, 247	+21. 5
1924	791, 715	−2. 8	1, 169, 598	5. 4	766, 435	+4. 7

[a] For explanation of changes in figures of supply for 1921 and 1923, see footnotes to table on page 389.

Comparison of the supply and demand for the past few years shows that between 1918 and 1924 the annual new supply increased 101 per cent, the annual total supply increased 111 per cent, and the annual indicated total demand increased only 84 per cent. Although both supply and demand have increased each year, with the exception of the decreased demand in 1921 and the decreased new supply in 1924, the rates of increase have varied considerably, as shown in the table.

In 1924, the demand for crude petroleum continued to increase but at a decreased rate compared with that of the two preceding years. The increase in annual indicated domestic demand plus exports was only 4.7 per cent in 1924 as contrasted with 21.5 per cent in 1923 and 12.6 per cent in 1922. In 1921, a year of industrial depression, domestic demand plus exports decreased 0.8 per cent from 1920, which was a year of pronounced prosperity in the petroleum industry, when the demand increased 26.5 per cent over that for 1919.

Since 1920, the annual increase in demand for crude petroleum has been less than the annual increase in total supply, whereas in 1920 and a number of preceding years—including the period of the war—back to the oversupply that followed the flush production of the Cushing field, conditions were reversed and the annual increase in demand was greater than the annual increase in total supply.

Throughout the period of oversupply, except only the year 1923, the domestic production of petroleum was less than the demand, so that only in that year was there distinct overproduction and even then domestic production exceeded domestic demand plus exports by only 160,000 barrels. The difference between insufficient domestic output and the requirements of the industry have been made up by imports; and, although more petroleum was imported than was required to prevent depletion of stocks in general, the foreign oil has been consumed and the chief increase of stocks has been in domestic grades. Thus in 1924 not only was the full quantity of imports delivered to consumers but stocks of imported oil were drawn upon.

The monthly relation between the new supply (production plus imports) and domestic demand plus exports from January, 1923, to December, 1924, is illustrated in Figure 16. From January to May, 1920, the demand exceeded the new supply. But from June,

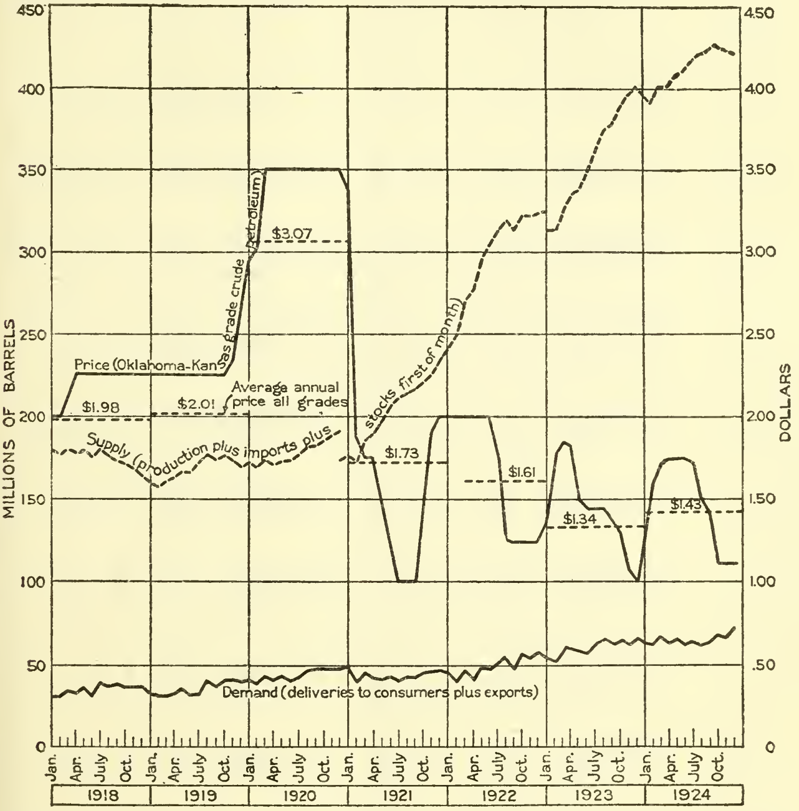

FIGURE 17.—Supply and demand for crude petroleum, average price by months of typical Mid-Continent crude petroleum, and average annual price of all grades in the United States, 1918–1924

1920, to August, 1924, except only December, 1922, and January, 1924, a period of 38 months, the demand was not only less than the new supply but from May to November, 1923, was less than domestic production. This condition changed in September, 1924, and during the last three months of the year the demand was considerably greater than the new supply and stocks were drawn upon.

Indicated deliveries of crude petroleum to domestic consumers, 1923–24, by months [a]

[Thousands of barrels of 42 U. S. gallons]

	January	February	March	April	May	June	July	August	September	October	November	December	The year
1923													
Domestic petroleum, by fields of origin:													
Appalachian	2, 291	1, 952	2, 156	2, 541	2, 578	2, 283	2, 328	2, 333	2, 403	2, 346	2, 315	2, 262	27, 783
Lima-Indiana	148	161	173	192	193	198	201	185	191	178	161	145	2, 126
Illinois and southwestern Indiana	767	702	656	588	687	847	661	613	542	595	791	1, 114	8, 563
Mid-Continent	24, 279	23, 219	25, 361	24, 431	23, 332	22, 497	24, 460	28, 515	21, 503	27, 299	26, 622	25, 533	297, 051
Gulf coast	3, 178	3, 439	3, 262	3, 009	2, 616	2, 762	2, 959	2, 566	2, 467	2, 307	2, 330	3, 208	34, 103
Rocky Mountain	[b] 14	2, 590	2, 488	2, 839	2, 849	2, 841	3, 481	2, 133	2, 647	2, 726	2, 341	2, 691	29, 640
California	16, 221	13, 758	18, 534	19, 886	20, 871	20, 358	22, 613	22, 224	28, 043	22, 819	21, 629	23, 133	250, 089
Other	1	1	2	1	2	1	2	2	1	2	1	2	18
Deliveries and exports	46, 899	45, 822	52, 632	53, 487	53, 128	51, 787	56, 705	58, 571	57, 797	58, 272	56, 190	58, 088	649, 378
Exports of domestic crude oil	748	636	1, 004	1, 479	1, 306	2, 573	1, 518	1, 511	1, 561	1, 292	1, 364	2, 069	17, 061
Deliveries in the United States and Territories	46, 151	45, 186	51, 628	52, 008	51, 822	49, 214	55, 187	57, 060	56, 236	56, 980	54, 826	56, 019	632, 317
Foreign petroleum delivered in the United States and Territories	8, 078	6, 306	8, 068	6, 732	5, 989	5, 931	6, 870	7, 548	5, 988	6, 620	6, 034	7, 835	81, 999
	54, 229	51, 492	59, 696	58, 740	57, 811	55, 145	62, 057	64, 608	62, 224	63, 600	60, 860	63, 854	714, 316
1924													
Domestic petroleum, by fields of origin:													
Appalachian	1, 948	2, 348	2, 558	2, 567	2, 131	2, 275	2, 028	2, 360	2, 215	2, 280	2, 035	2, 246	26, 991
Lima-Indiana	220	171	156	196	180	164	148	148	136	176	192	157	2, 044
Illinois and southwestern Indiana	703	777	775	846	602	799	710	516	692	850	872	825	8, 967
Mid-Continent	29, 120	28, 054	30, 963	27, 025	30, 202	27, 344	31, 001	30, 439	32, 562	31, 579	33, 611	36, 786	368, 686
Gulf coast	2, 794	2, 402	3, 295	2, 994	2, 699	3, 877	1, 891	2, 315	2, 200	2, 758	2, 749	2, 735	32, 709
Rocky Mountain and Alaska	2, 689	2, 517	2, 778	2, 752	2, 811	2, 758	2, 791	2, 403	3, 256	3, 679	2, 972	2, 716	34, 122
California	19, 543	19, 304	17, 867	19, 035	18, 511	18, 295	18, 582	18, 305	16, 227	20, 181	17, 201	19, 177	222, 228
Deliveries and exports	57, 017	55, 573	58, 392	55, 415	57, 136	55, 512	57, 151	56, 486	57, 288	61, 503	59, 632	64, 642	695, 747
Exports of domestic crude oil	1, 480	1, 651	1, 450	1, 520	1, 823	1, 517	1, 369	1, 205	1, 815	1, 376	1, 436	963	17, 605
Deliveries in the United States and Territories	55, 537	53, 922	56, 942	53, 895	55, 313	53, 995	55, 782	55, 281	55, 473	60, 127	58, 196	63, 679	678, 142
Foreign petroleum delivered in the United States and Territories	6, 442	6, 520	8, 475	7, 168	7, 411	6, 807	6, 408	5, 850	5, 608	5, 055	6, 447	5, 865	78, 056
	61, 979	60, 442	65, 417	61, 063	62, 724	60, 802	62, 190	61, 131	61, 081	65, 182	64, 643	69, 544	756, 198

[a] Indicated deliveries equal production plus imports plus stocks, exclusive of refinery stocks, at beginning of period minus exports and stocks at end of period.
[b] Calculated result due to reclassification of certain stocks by transfer from refinery to tank farm.

The following tables give some details of the consumption of crude petroleum. The most important item, the quantity of crude oil run to stills at refineries, accounts for quantities ranging from 71 per cent of the annual new supply in 1923 to 81 per cent in 1924. The difference between the quantity run to stills and the total domestic demand indicates the quantity of crude petroleum consumed for fuel, which is shown by months for 1923 and 1924 in the following table:

Indicated domestic consumption of crude petroleum, 1923–24, by months

[Thousands of barrels of 42 U. S. gallons]

	January	February	March	April	May	June	July	August	September	October	November	December	The year
1923													
Runs to refinery stills	46,825	42,672	46,819	46,710	47,973	47,969	50,926	50,015	48,812	50,904	50,364	51,249	581,238
Indicated other consumption, chiefly for fuel (including losses)	11,295	10,621	9,857	11,820	9,670	6,969	9,268	13,903	14,930	11,780	11,153	12,358	133,624
	58,120	53,293	56,676	58,530	57,643	54,938	60,194	63,918	63,742	62,684	61,517	63,607	714,862
1924													
Runs to refinery stills	51,013	49,907	52,699	53,114	54,725	52,436	52,876	54,643	53,617	55,779	55,029	57,881	643,719
Indicated other consumption, chiefly for fuel (including losses)	10,132	7,454	11,142	6,688	7,509	8,367	9,844	5,822	6,551	10,633	9,529	11,072	104,743
	61,145	57,361	63,841	59,802	62,234	60,803	62,720	60,465	60,168	66,412	64,558	68,953	748,462

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[a] Indicated domestic consumption equals production plus imports plus total stocks of crude oil, including refinery stocks, at beginning of period minus exports and stocks at end of period.

The only available data showing details of consumption of crude and refined oil for fuel are those given below and in volumes 8 and 11 of the Fourteenth Census, published in 1922 and 1923, which show the consumption by certain industries in 1919.

Crude and fuel oil consumed for fuel, 1920–1924

[Thousands of barrels of 42 U. S. gallons]

	1920	1921	1922	1923	1924
Crude oil:					
On producing oil properties	4, 647	4, 261	5, 747	4, 316	4, 284
In operation of oil pipe lines east of California	([a])	1, 668	1, 767	1, 715	1, 852
Fuel and gas oil (including some crude oil):					
By locomotives (all services, class 1 carriers) [b]	45, 945	39, 558	43, 527	55, 580	58, 950
By vessels operated by or for account of U. S. Shipping Board [c]—					
Domestic oil	2, 000	3, 361	17, 515	19, 049	18, 579
Mexican oil	14, 742	11, 936			
Open-market purchase	4, 185	3, 824	714		
	20, 927	19, 121	18, 229	19, 049	18, 579
By vessels cleared to foreign countries (bunker oil) [d]	26, 335	27, 076	31, 692	37, 582	43, 328
By U. S. Navy (fiscal year) [e]	7, 530	6, 372	5, 827	7, 044	7, 100
By electric public-utility power plants [f]	13, 123	12, 045	13, 197	14, 679	16, 630
By manufacturers of gas	21, 982	[g] 21, 380	20, 381	[h] 22, 156	([a])

[a] Data not available.

[b] Interstate Commerce Commission.

[c] Estimated by U. S. Shipping Board Emergency Fleet Corporation.

[d] Bureau of Foreign and Domestic Commerce.

[e] Navy Department.

[f] U. S. Geol. Survey.

[g] American Gas Association.

[h] Bureau of the Census.

In the last few years, especially during the period of oversupply of oil, competition between coal and oil has been accelerated by the low price of crude petroleum and its products. An estimate of the quantity of crude petroleum, gas and fuel oils, and natural gas used for fuel during the years 1919 to 1924, with the indicated equivalent of coal displaced, determined on a basis of thermal units, is given in the following table:

Indicated domestic consumption of crude petroleum, gas and fuel oils, and natural gas for fuel, 1919–1924, contrasted with the equivalent quantity of coal [a]

	1919	1920	1921	1922	1923	1924
1. Indicated domestic consumption of crude petroleum [b]	423	522	521	585	715	748
2. Crude oil run to refinery stills	362	434	443	501	581	644
3. Indicated consumption of crude petroleum for fuel (including losses)	61	88	78	84	134	104
4. Indicated consumption of gas and fuel oils	164	186	196	240	261	293
5. Consumption of crude petroleum and gas and fuel oils for fuel	225	274	274	324	395	397
6. Energy equivalent of No. 5	1, 383	1, 681	1, 683	1, 992	2, 422	2, 431
7. Approximate equivalent in coal of No. 5	53	64	64	76	92	93
8. Energy equivalent of natural gas consumed for fuel (gas used in making carbon black not included)	748	814	657	762	[c] 965	1, 059
9. Approximate equivalent in coal of natural gas in No. 8	29	31	25	29	37	40
10. Percentage of the annual production of coal in the United States for Nos. 6 and 8	15	14	18	22	20	23

[a] Units used in table: Oil, millions of barrels; natural gas, billions of cubic feet; coal, millions of short tons; energy equivalent, trillions of British thermal units.

[b] Use of refinery stocks of crude oil in computation of consumption for years prior to 1923 involves a small but unavoidable error due to duplication in figures for stocks.

[c] Revised figures.

It is noteworthy that in 1919 the indicated consumption of crude oil and gas and fuel oils for fuel was 225,000,000 barrels, whereas in 1924 the quantity so used had increased to 397,000,000 barrels. Of the total energy supplied by mineral fuels produced in the United States in 1924 coal yielded 72 per cent, petroleum 22 per cent, and natural gas 6 per cent, whereas in 1913 coal yielded 87 per cent of the total, petroleum 9 per cent, and gas 4 per cent.

PRICES

The average price per barrel paid for crude petroleum at the wells, by States, for 1923 and 1924 is shown in the following table. For the States east of California the figures were compiled from reports of actual purchases made by purchasing companies, including premiums; for California the figures are those compiled by the State Mining Bureau. In 1924, the average price per barrel, by States, ranged from 94 cents in Arkansas to $3.64 in New York, contrasted with a range in 1923, from 69 cents in Arkansas to $3.33 in Pennsylvania. In 1924, the average annual price for all grades of crude petroleum was $1.43, contrasted with $1.34 in 1923, $1.61 in 1922, $1.73 in 1921, and $3.07 in 1920.

The value at the wells of all the oil produced in the United States in 1924 was $1,022,683,000, contrasted with $978,430,000 in 1923. Notwithstanding the considerably greater quantity produced, the value of the annual production of petroleum in the United States for the past few years has been much less than the maximum, which was attained in 1920 and amounted to $1,360,745,000, the average price per barrel in that year being $3.07.

The posted price per barrel of crude petroleum at the wells and dates of change, as announced by various purchasers during 1923 and 1924, are given in the tables on pages 434–445.

In 1923, although there was an upward movement of prices elsewhere than in California, in the first few months of the year, the general trend was downward and in December prices of typical Mid-Continent grade crude oil fell to the low point reached during the period of postwar deflation in 1921. During the first part of 1924, prices rose again and remained for several months near the high point for the year, but during the summer and fall the prices of most of the principal grades, except California, were reduced and, at the end of December, were at or near the January prices. Prices of California crude oil were also increased in January and February but were not reduced as were those for all grades east of California, reflecting the continued increasing supply.

The posted prices of Pennsylvania-grade crude oil may illustrate the variations during 1924.

The price on January 1 of Pennsylvania-grade crude petroleum in the lines of the National Transit, Southwest Pennsylvania, Eureka, and Buckeye pipe-line companies was $3 a barrel. There were four increases of 25 cents a barrel during the month, and on January 30 the price was $4 and remained at this figure until May 10, when it was reduced to $3.75. On June 14, the price was reduced to $3.25; on July 7, to $3; and on August 5, the price was reduced to $2.75 a barrel, where it remained until December 27, when it was increased to $3, the same price at which the year opened.

Details of the changes in price of the various other grades and the average price per barrel are shown in the tables.

Relations between the monthly supply and demand of crude petroleum, the average price of typical Mid-Continent crude oil, and the averare annual price of all grades of crude oil in the United States for 1918 to 1924, inclusive, are shown in Figure 17.

Average price per barrel paid for crude petroleum at the wells, 1922–1924, by States

[Based on actual purchases, including premiums]

State	Average price per barrel at the well			State	Average price per barrel at the well		
	1922	1923	1924		1922	1923	1924
Arkansas	$1.61	$0.69	$0.94	Ohio:			
California [a]	1.25	.92	1.20	Central and eastern	$2.70	$2.57	$2.74
Colorado	1.18	1.19	1.10	Northwestern	2.25	2.02	2.00
Illinois	2.06	1.87	1.76	Total Ohio	2.56	2.41	2.52
Indiana:				Oklahoma	1.73	1.74	1.57
Southwestern	2.04	1.82	1.80	Pennsylvania	3.21	3.33	3.61
Northeastern	2.08	1.84	1.93	Tennessee	1.73	1.75	1.80
Total Indiana	2.05	1.82	1.84	Texas:			
Kansas	1.77	1.63	1.54	Gulf coast	1.19	1.39	1.56
Kentucky	1.98	1.97	1.97	Rest of State	1.76	1.50	1.51
Louisiana:				Total Texas	1.59	1.48	1.52
Gulf coast	1.25	1.36	1.63	West Virginia	3.26	3.27	3.52
Northern	1.52	1.48	1.41	Wyoming	1.27	1.09	1.23
Total Louisiana	1.50	1.47	1.44	Other	2.54	2.28	3.38
Montana	1.65	1.47	1.33				
New Mexico	([b])	([b])	1.30	United States	1.61	1.34	1.43
New York	3.14	3.31	3.64				

[a] California State Mining Bureau.

[b] Included under "Other."

Posted price per barrel of crude petroleum at wells, 1923–24, by grades, with dates of change

Date	Appalachian field [a]								Lima-Indiana field [b]		Illinois and southwestern Indiana field [b]		
	Pennsylvania		Cabell	Corning	Wooster[b]	Ragland, 22°–28°	Somerset		Lima-Ohio	Indiana	Illinois and Princeton, Ind.	Plymouth	Waterloo
							Heavy 32°–38°	Light above 38°					
1923													
Jan. 1	$3.25		$2.11	$1.75	$1.90	$1.00	$1.90	$2.15	$1.98	$1.78	$1.77	$1.15	$1.25
Jan. 15					2.00				2.08	1.88	1.87	1.25	1.35
Jan. 16	3.35		2.21	2.00			2.00	2.25					
Jan. 18	3.45		2.31		2.10		2.10	2.35	2.18	1.98	1.97	1.35	1.45
Jan. 29	3.55		2.41				2.20	2.45					
Jan. 30				2.15									
Jan. 31					2.20				2.28	2.08	2.07	1.45	1.55
	Pennsylvania-grade oil in New York Transit Co. lines and Bradford-grade oil in National Transit Co. lines	Pennsylvania-grade oil in lines of National Transit Co., Southwest Pa. Pipe Line Co., Eureka Pipe Line Co., and Buckeye Pipe Line Co.	Cabell-grade oil in lines of Eureka Pipe Line Co.	Corning-grade oil in lines of Buckeye Pipe Line Co.		Ragland-grade oil in lines of Cumberland Pipe Line Co.	Somerset oil in lines of Cumberland Pipe Line Co.						
							Medium	Light					
Feb. 1	$3.80	$3.65	$2.51	$2.15		$1.00	$2.30	$2.55					
Feb. 3	3.90												
Feb. 5					2.30				2.38	2.18	2.17	1.55	1.65
Feb. 8	4.00	3.75	2.61				2.40	2.65					
Feb. 13					2.40				2.48	2.28	2.27	1.65	1.75
Feb. 15	4.25	4.00	2.76			1.10	2.55	2.80					
Feb. 19					2.50				2.58	2.38	2.37	1.75	1.85
Apr. 11	4.00	3.75	2.41				2.20	2.45					
Apr. 12									2.48	2.28	2.27	1.65	1.75
Apr. 24					2.25				2.38	2.18	2.17	1.55	1.65
May 3	3.75	3.50	2.16	2.00			1.95	2.20					
May 4					2.15				2.28	2.08	2.07	1.45	1.55
May 14	3.50	3.25	1.91	1.85	2.05	1.00	1.75	2.00	2.18	1.98	1.97	1.35	1.45

June 18	3.25	3.00	1.71	1.70		.90	1.55	1.75					
June 19					1.90								
June 28									2.08	1.88	1.87	1.25	1.35
July 10	3.00	2.75	1.50	1.60		.75	1.40	1.55					
July 17					1.80								
July 19					1.70				1.88	1.68	1.67	1.05	1.15
Sept. 20	2.75	2.50	1.35	1.45	1.50		1.25	1.40	1.68	1.48	1.47	.85	.95
Nov. 8											1.22		
Nov. 9					1.25				1.43	1.23		.60	.70
Nov. 13	2.60	2.35	1.20				1.15	1.30					
Nov. 14				1.25									
Dec. 14	2.85	2.60											
Dec. 21			1.35	1.40	1.40				1.53	1.33	1.32	.70	.80
Dec. 22							1.30	1.45					
Dec. 26	3.10	2.85											
Dec. 28			1.45			.85	1.40	1.55					
Dec. 31	3.25	3.00											
Average for year	3.33	3.10	1.86	1.74	1.89	.90	1.72	1.92	2.03	1.83	1.82	1.20	1.30
1924													
Jan. 2					1.50				1.63	1.43	1.42	.80	.90
Jan. 7	3.40			1.55									
Jan. 10	3.65	3.25	1.60		1.70		1.60	1.80	1.83	1.63	1.62	1.00	1.10
Jan. 14	3.75			1.65									
Jan. 19	4.00	3.50	1.75			.90	1.75	1.95					
Jan. 21					1.80				1.93	1.73	1.72	1.10	1.20
Jan. 25	4.25	3.75	1.90	1.80		1.00	2.00	2.20					
Jan. 30	4.50	4.00	2.05				2.15	2.35					
Feb. 4					2.00				2.13	1.93	1.92	1.30	1.40
Feb. 13				1.95									
Mar. 8					2.15				2.28	2.08	2.07	1.45	1.55
Mar. 10			2.20	2.15		1.10	2.30	2.50					
May 10	4.25	3.75	1.95				2.05	2.25					
June 14	3.75	3.25	1.70			1.00	1.80	2.00					
June 16				1.90	2.00								
July 7	3.25	3.00	1.60				1.70	1.85	2.18	1.98	1.97	1.35	1.45
July 17					1.90				2.08	1.88	1.87	1.25	1.35
July 29									1.83	1.63	1.62	1.00	1.10
July 30					1.65								
Aug. 2				1.75									
Aug. 5	3.00	2.75	1.45			.90	1.55	1.70					
Aug. 21	2.85												
Sept. 6				1.65									
Sept. 13					1.55				1.73	1.53	1.50	.90	.90
Sept. 18					1.40				1.58	1.38	1.37	.75	.75
Oct. 2				1.50									
Dec. 27	3.10	3.00											
Average for year	3.61	3.29	1.73	1.81	1.79	.98	1.82	2.00	1.95	1.75	1.74	1.12	1.19

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[a] Joseph Seep Purchasing Agency, except for Wooster.

[b] Ohio Oil Co.

Posted price per barrel of crude petroleum at wells, 1923–24, by grades, with dates of change—Continued

Date	Mid-Continent field																				
	Kansas-Oklahoma; north central, east, and south central, Texas																	North Louisiana and Arkansas [c]			
	Gravity basis [d]								Corsicana [e]		Currie 40° and above (f)	Mexia (e)	Mirando (e)	Powell (g)	Richland (g)	Thrall (e)	Wortham (g)	Bellevue below 32°	Bull Bayou		
	Below 28°	28°–29.9°	30°–32.9°	33°–34.9°	35°–36.9°	37°–38.9°	39° and above		Heavy	Light									32°–34.9°	35°–37.9°	38° and above
1923																					
Jan. 1	$0.90	$1.00	$1.10	$1.25	$1.40	$1.60	$1.80		$0.65	$1.00	$1.80	$1.55	$0.65	------	------	$1.00	------	$0.75	$1.25	$1.30	$1.40
							39°–40.9°	41° and above													
Jan. 13	1.00	1.10	1.20	1.35	1.50	1.70	$1.90	$2.10	------	------	------	------	------	------	------	------	------	------	------	------	------
Jan. 15	------	------	------	------	------	------	------	------	------	1.10	------	------	------	------	------	------	------	------	------	------	------
Jan. 17	1.10	1.20	1.30	1.45	1.60	1.80	2.00	2.20	------	------	------	------	------	------	------	------	------	------	------	------	------
Jan. 18	------	------	------	------	------	------	------	------	.70	1.20	------	------	------	------	------	------	------	.85	1.35	1.40	1.50
											41° and above										
Jan. 23	------	------	------	------	------	------	------	------	------	------	$2.20	------	------	------	------	------	------	------	------	------	------
Jan. 24	------	------	------	------	------	------	------	------	------	------	------	1.80	------	------	------	------	------	------	------	------	------
Jan. 26	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	.95	1.45	1.50	1.60
Jan. 27	1.20	1.30	1.40	1.55	1.70	1.90	2.10	2.30	------	------	------	------	------	------	------	------	------	------	------	------	------
Jan. 30	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	1.05	1.55	1.60	1.70
Feb. 1	------	------	------	------	------	------	------	------	------	------	2.30	------	------	------	------	------	------	------	------	------	------
Feb. 2	1.30	1.40	1.50	1.65	1.80	2.00	2.20	2.40	------	1.30	2.40	1.90	------	------	------	------	------	------	------	------	------
Feb. 3	------	------	------	------	------	------	------	------	------	------	------	2.00	------	------	------	------	------	1.15	1.65	1.70	1.80
Feb. 10	1.40	1.50	1.60	1.75	1.90	2.10	2.30	2.50	------	------	2.50	------	------	------	------	------	------	------	------	------	------
Feb. 12	------	------	------	------	------	------	------	------	------	------	------	2.10	------	------	------	------	------	1.25	1.75	1.80	1.90
Feb. 13	------	------	------	------	------	------	------	------	.85	1.45	------	------	.75	------	------	------	------	------	------	------	------
Feb. 17	1.50	1.60	1.70	1.85	2.00	2.20	2.40	2.60	.90	1.50	2.60	2.20	------	------	------	------	------	1.35	1.85	1.90	2.00

Apr. 5											2.40										
Apr. 6												2.00									
Apr. 20																		1.15			
Apr. 23	1.40	1.50	1.60	1.75	1.90	2.10	2.30	2.50	.80	1.40	2.30										
Apr. 24												1.90						1.05	1.75	1.80	1.90
May 2	1.30	1.40	1.50	1.65	1.80	2.00	2.20	2.40	.75	1.35	2.20	1.80									
May 3																		.95	1.65	1.70	1.80
May 5	1.20	1.30	1.40	1.55	1.70	1.90	2.10	2.30	.70	1.30	2.10	1.70									
May 7																			1.55	1.60	1.70
May 12	1.10	1.20	1.30	1.45	1.60	1.80	2.00	2.20		1.25	2.00	1.60									
May 14											1.90							.85	1.45	1.50	1.60
June 23									.65	1.00	1.70	1.50									
June 28											1.35			$1.00							
June 29									.60	.90		1.25									
July 3											[h] 1.00	1.00									
July 5										.75											
July 20									.50												
Aug. 1										1.00											
Aug. 3																			1.20	1.25	1.35
Sept. 10																		.75	1.00	1.05	1.15
	Below 33°			33°-39.9°			40° and above														
Sept. 19	$0.90			$1.30			$1.75														
Oct. 30										.75											
Nov. 8	.75			1.00			1.25		.40												
Nov. 15																			.75	.90	1.05
Nov. 19										1.00											
Dec. 27											1.25			1.25							
Dec. 28									.50	1.25		1.25									
Dec. 29																		.90	.90	1.05	1.20
Average for year									.63	1.13	1.60	1.43	.74	1.00				.93	1.34	1.40	1.51

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[c] Standard Oil Co. of Louisiana.
[d] Prairie Oil & Gas Co.
[e] Magnolia Petroleum Co.
[f] The Texas Co.
[g] Humble Oil & Refining Co.
[h] Gravity discontinued.

Posted price per barrel of crude petroleum at wells, 1923–24, by grades, with dates of change—Continued

Date	Mid-Continent field—Continued																	
	Kansas-Oklahoma; north central, east, and south central, Texas														North Louisiana and Arkansas			
	Gravity basis					Corsicana		Currie 40° and above	Mexia	Mirando	Powell	Richland	Thrall	Wortham	Bellevue below 32°	Bull Bayou		
	Below 33°		33°–35.9°	36°–38.9°	39° and above	Heavy	Light									32°–34.9°	35°–37.9°	38° and above
1924																		
Jan. 9	$1.00		$1.25	$1.40	$1.50						$1.35							
Jan. 10							$1.35	$1.50	$1.35						$1.15	$1.00	$1.15	$1.30
Jan. 14											1.40							
Jan. 15							1.40		1.40									
Jan. 19	1.15		1.40	1.60	1.75	$0.75	1.60	1.75	1.60		1.60							
Jan. 21															1.30	1.15	1.30	1.45
	Below 30°	30°–32.9°																
Feb. 2	$1.15	$1.30	1.60	1.85	2.00	1.00	1.85	2.00	1.85		1.85							
Feb. 6															1.55	1.35	1.50	1.65
Mar. 8	1.25	1.45	1.75	2.00	2.25		2.00	2.25	2.00		2.00							
Mar. 11																1.50	1.65	1.80
Apr. 3															1.75			
May 10							1.75		1.75		1.75							
May 19											2.00							
June 6						.90	1.50		1.50									
July 8											1.75							
July 9								2.00							1.50	1.25	1.40	1.55
			33° and above															
July 17			$1.75								1.50							
July 18								1.50										
July 19															1.25	1.00	1.15	1.30
July 26							1.25		1.25									
July 28	1.10	1.25	1.50															

Aug. 9										1.35	$1.35						
Aug. 11							1.35										
Sept. 17	.85	1.00	1.25				1.25			1.25	1.25						
Sept. 20														1.10	.85	1.00	1.15
			33°-35.9°	36° and above													
Sept. 27	.75	.90	$1.10	$1.25													
Nov. 12														1.35			
Dec. 19													$1.25				
Average for year	1.06	1.21	1.47		.91	1.53	1.73	1.53	$0.75	1.61	1.28	$1.00	1.25	1.42	1.17	1.32	1.47

Posted price per barrel of crude petroleum at wells, 1923–24, by grades, with dates of change—Continued

Date	Mid-Continent field—Continued														
	North Louisiana and Arkansas—Continued														
	Crichton 38° and above	De Soto 38° and above	Caddo, Haynesville, Homer, El Dorado						Smackover					Calion ¹	Cotton Valley
			Below 30°	30°–32.9°	33°–34.9°	35°–36.9°	37°–38.9°	39° and above							
1923															
Jan. 1	$1.25	$1.60	$0.75	$1.10	$1.25	$1.40	$1.60	$1.80	$0.30					-------	-------
									Below 26°				26° and above		
Jan. 3	-------	-------	-------	-------	-------	-------	-------	-------	$0.30				$0.75	-------	-------
Jan. 18	-------	-------	.85	1.20	1.35	1.50	1.70	1.90	.40				.85	-------	-------
Jan. 26	-------	-------	.95	1.30	1.45	1.60	1.80	2.00	.50				.95	-------	-------
Jan. 30	-------	-------	1.05	1.40	1.55	1.70	1.90	2.10	.60				1.05	-------	-------
Feb. 3	-------	-------	1.15	1.50	1.65	1.80	2.00	2.20	.70				1.15	-------	-------
Feb. 12	-------	-------	1.25	1.60	1.75	1.90	2.10	2.30	.80				1.25	-------	-------
Feb. 17	-------	-------	1.35	1.70	1.85	2.00	2.20	2.40	.90				1.35	-------	-------
									Below 22°	22°–23.9°	24°–24.9°	25°–25.9°			
Mar. 8	-------	-------	-------	-------	-------	-------	-------	-------	$0.90	$1.00	$1.10	$1.20	-------	-------	-------
Mar. 28	-------	-------	-------	-------	-------	-------	-------	-------	.80	-------	-------	-------	-------	-------	-------
Apr. 13	-------	-------	-------	-------	-------	-------	-------	-------	.70	.90	1.00	1.10	1.25	-------	-------
Apr. 24	1.75	2.10	1.25	1.60	1.75	1.90	2.10	2.30	.60	.80	.90	1.00	1.15	-------	-------
									Below 24°						
May 3	1.65	2.00	1.15	1.50	1.65	1.80	2.00	2.20	$0.50		.80	.90	1.05	-------	-------
May 7	1.55	1.90	1.05	1.40	1.55	1.70	1.90	2.10	-------		.70	.80	.95	-------	-------
May 14	1.45	1.80	.95	1.30	1.45	1.60	1.80	2.00	.40		.60	.70	.85	-------	-------

			Caddo				Haynesville		Homer				El Dorado							
			Below 32°	32°–34.9°	35°–37.9°	38° and above	Below 33°	33° and above	Below 31°	31°–32.9°	33°–34.9°	35° and above	Below 33°	33° and above						
Aug. 3	[h]1.10	[h]1.45	$0.95	$1.30	$1.35	$1.45	$1.20	$1.30	$0.95	$1.30	$1.35	$1.45	$1.30	$1.45						
Sept. 10	.90	1.25	.75	1.10	1.15	1.25	1.00	1.10	.75	1.10	1.15	1.25	1.10	1.25		.50	.60	.75		
Nov. 15		1.10		.90	1.00	1.10	.90	1.00		.90	1.00	1.10	1.00	1.10						
Dec. 29	1.05	1.25	.90	1.05	1.15	1.25	1.05	1.15	.90	1.05	1.15	1.25	1.15	1.25	.55	.65	.75	.90		
Average for year	1.33	1.66														.64	.73	.93		
1924																				
Jan. 5																			$0.55	
Jan. 10	1.15	1.35	1.00	1.15	1.25	1.35	1.15	1.25	1.00	1.15	1.25	1.35	1.25	1.35	.65	.75	.85	1.00	.65	
Jan. 21	1.30	1.50	1.15	1.30	1.40	1.50	1.30	1.40	1.15	1.30	1.40	1.50	1.40	1.50	.80	.90	1.00	1.15	.80	
Feb. 6	1.50	1.70	1.35	1.50	1.60	1.70	1.50	1.60	1.35	1.50	1.60	1.70	1.60	1.70	1.00	1.10	1.20	1.35	1.00	
Mar. 11	1.65	1.85	1.50	1.65	1.75	1.85	1.65	1.75	1.50	1.65	1.75	1.85	1.75	1.85						
June 10															.85	.95	1.05	1.20	.85	
June 14																				$1.00
July 9	1.40	1.60	1.25	1.40	1.50	1.60	1.40	1.50	1.25	1.40	1.50	1.60	1.50	1.60	.70	.80	.90	1.05	.70	.90
July 19	1.15	1.35	1.00	1.15	1.25	1.35	1.15	1.25	1.00	1.15	1.25	1.35	1.25	1.35	.60	.70	.80	.95	.60	.80
Sept. 20	1.00	1.20					1.00	1.10	.85	1.00	1.10	1.20	1.10	1.20	.75				.75	
Sept. 27							.90	1.00	.75	.90	1.00	1.10	1.00	1.10	.85				.85	
															Below 25°		25° and above			
Oct. 6															$0.85		$0.95			
Oct. 8													.90	1.00						
Oct. 27																				.95
Average for year	1.32	1.52	1.21	1.36	1.46	1.56	1.29	1.39	1.14	1.29	1.39	1.49	1.37	1.47					.84	.93

[h] Gravity discontinued.

[i] Gulf Refining Co. of Louisiana.

Posted price per barrel of crude petroleum at wells, 1923–24, by grades, with dates of change—Continued

Date	Gulf coast field							
	Coastal Texas							Coastal Louisiana [i]
	Batson, Cow Bayou, Goose Creek, Hull, Saratoga, Sourlake, Spindletop [k]			Big Creek [k]	Blue Ridge, Pierce Junction [k]	High Island [l]	Humble, Markham, West Columbia [m]	Edgerley, Jennings, Vinton
1923								
Jan. 1	$1.25			------	$0.80	------	$1.25	$1.25
Feb. 8	1.50			------	1.05	------	------	1.50
Mar. 15	1.75			------	1.30	------	------	1.75
	Batson, Cow Bayou, Saratoga, Spindletop [k]	Goose Creek, Hull, Sourlake						
		Grade A [k]	Grade B [k]					
July 3	$1.50	$1.50	$1.25	------	1.15	------	------	1.50
July 9	------	------	------	------	------	------	1.50	------
July 25	1.25	1.25	1.00	------	.90	------	------	1.25
July 26	------	------	------	------	------	------	1.25	------
Aug. 18	1.00	1.00	------	------	------	------	------	1.00
Aug. 20	------	------	------	------	------	------	1.20	------
Oct. 16	.75	.75	.75	------	.65	------	------	.75
Nov. 1	1.00	1.00	1.00	------	.90	------	------	1.00
Dec. 27	1.25	1.25	------	------	1.00	------	1.25	1.25
Average for year	1.34	1.34	1.30	------	1.03	------	1.24	1.34
1924								
Jan. 10	1.50	1.50	1.25	------	1.25	------	1.50	1.50
Jan. 25	1.65	1.65	1.40	------	1.40	------	1.65	1.65
Mar. 20	1.80	1.80	1.50	------	1.50	------	1.80	1.80
Apr. 1	2.00	2.00	1.70	------	1.70	------	2.00	2.00
July 9	------	------	------	------	------	------	1.75	------
July 10	1.75	1.75	1.45	------	1.45	------	------	1.75
July 18	1.50	1.50	1.30	------	1.30	------	1.50	1.50
Aug. 11	1.35	1.35	1.15	------	1.15	------	1.35	1.53

Aug. 12						$0.85		
Sept. 17	1.25	1.25	1.05		1.05		1.25	1.25
Sept. 18						.75		
Oct. 27				$1.05				
Nov. 6	1.50	1.50	1.25	1.25	1.25	.95	1.50	1.50
Average for year	1.62	1.62	1.37	1.22	1.37	.85	1.62	1.61

Date	Rocky Mountain field [n]															
	Big Muddy	Cat Creek, Greybull, Torchlight	Elk Basin	Ferris Dome	Grass Creek	Hamilton Dome	Lance Creek	Lander	Mule Creek	Osage	Pilot Butte	Rock Creek	Salt Creek	Sunburst		
1923																
Jan. 1	$1.05	$1.50	$1.50	$1.25	$1.50	$1.05	$1.50	$0.70	$0.90	$1.50	$0.8014	$1.15	$1.05	$0.70		
														Below 28°	28°–33.9°	34° and above
Jan. 15	1.15	1.60	1.60	1.35	1.60	1.15	1.60		1.00	1.60	.9014	1.25	1.15	$0.80	$0.90	$1.00
Jan. 18	1.25	1.70	1.70	1.45	1.70	1.25	1.70		1.10	1.70	1.0014	1.35	1.25	.90	1.00	1.10
Jan. 29	1.35	1.80	1.80	1.55	1.80	1.35	1.80		1.20	1.80	1.1014	1.45	1.35	1.00	1.10	1.20
Feb. 2		1.90		1.65		1.45				1.90	1.2014		1.45			
Feb. 3	1.45		1.90		1.90		1.90		1.30			1.55		1.10	1.20	1.30
Feb. 10	1.55	2.00	2.00	1.75	2.00	1.55	2.00		1.40	2.00	1.3014	1.65	1.55	1.20	1.30	1.40
Feb. 17	1.65	2.10	2.10	1.85	2.10	1.65	2.10		1.50	2.10	1.4014	1.75	1.65	1.30	1.40	1.50
Mar. 21														$1.40		
Apr. 12														1.30		
Apr. 24	1.55	2.00	2.00	1.75	2.00	1.55	2.00		1.25	2.00	1.3014	1.65	1.55	1.00		
May 3	1.45	1.90	1.90	1.65	1.90	1.45	1.90		1.15	1.90	1.2014	1.55	1.45	.90		
May 7	1.35	1.80	1.80	1.55	1.80	1.35	1.80		1.05	1.80	1.1014	1.45	1.35	.80		
May 14	1.25	1.70	1.70	1.45	1.70	1.25	1.70		.95	1.70	1.0014	1.35	1.25			
June 6														.70		

[j] Gulf Refining Co. of La.
[k] Gulf Pipe Line Co.
[l] Sun Pipe Line Co.
[m] The Texas Co.
[n] Ohio Oil Co. and Midwest Refining Co.

Posted price per barrel of crude petroleum at wells, 1923–24, by grades, with dates of change—Continued

Date	Rocky Mountain field—Continued														
	Big Muddy	Cat Creek, Greybull, Torchlight	Elk Basin	Ferris Dome	Grass Creek		Hamilton Dome	Lance Creek	Lander	Mule Creek	Osage	Pilot Butte	Rock Creek	Salt Creek	Sunburst
					Light	Heavy									
1923—Continued															
June 14					$1.70	$0.90									
July 31													$1.25		
Aug. 10	$1.10														
Sept. 21	.75	$1.35	$1.35	$1.10	1.35		$0.825	$1.20		$0.75	$1.35	$0.5014	.90	$0.90	
Oct. 20											1.20				
Nov. 9	.45	.95	.95	.80	.95		.525	.80		.45	.80	.40	.60	.60	
Nov. 20								.90			.90				
Average for year	1.14	1.63	1.63	1.40	1.63	1.35	1.17	1.60	$0.70	.98	1.61	.94	1.25	1.20	
1924															
Jan. 10	.85	1.40	1.40	1.20	1.40		.925	1.35		.70	1.35	.6014	1.10	1.00	
Jan. 21	1.10	1.55	1.55	1.40	1.55		1.15	1.50			1.50	.8514	1.30	1.20	
Feb. 4														1.45	
Feb. 5	1.35	1.80	1.80	1.65	1.80		1.40	1.75		.95	1.75	1.1014	1.55		$0.95
Mar. 10	1.50	1.95	1.95	1.80	1.95		1.55	1.90		1.10	1.90	1.2514	1.70	1.60	1.05
July 18	1.25	1.70	1.70	1.55	1.70		1.30	1.65		.85	1.65	1.0014	1.45	1.35	.98
July 29	1.10	1.55	1.55	1.30	1.55		1.10	1.50		.70	1.50	.8514	1.30	1.10	.93
July 30	1.00	1.45	1.45		1.45		1.05	1.40		.60	1.40	.7514	1.20		.90
Sept. 19	.75	1.20	1.20	1.05	1.20		.80	1.15			1.15	.5014	.95	.85	
Sept. 23									.45						
Average for year	1.13	1.59	1.59	1.44	1.59	.90	1.18	1.54	.63	.82	1.54	.89	1.33	1.24	.94

Date	California field [o]																							
	14°–19.9°	20°–20.9°	21°–21.9°	22°–22.9°	23°–23.9°	24°–24.9°	25°–25.9°	26°–26.9°	27°–27.9°	28°–28.9°	29°–29.9°	30°–30.9°	31°–31.9°	32°–32.9°	33°–33.9°	34°–34.9°	35° and above	35°–35.9°	36°–36.9°	37°–37.9°	38°–38.9°	39°–39.9°	40°–40.9°	41°–41.9°	42° and above
1923																									
Jan. 1	$0.60	$0.63	$0.67	$0.73	$0.80	$0.88	$0.96	$1.05	$1.15	$1.25	$1.35	$1.45	$1.55	$1.65	$1.75	$1.85	$1.95								
Jan. 6	------	.62	.65	.70	.75	.80	.85	.90	.95	1.00	1.05	1.11	1.17	1.24	1.31	1.38	1.45								
Apr. 10 [p]	------	.61	.62	.65	.68	.71	.74	.77	.80	.83	.86	.89	.92	.95	.98	1.01	1.04								
Aug. 1 [q]	------	.61	.62	.65	.68	.71	.74	.77	.80	.83	.86	.89	.92	.95	.98	1.01	1.04								
Oct. 9	------	------	------	.63	.64	.65	.66	.67	.68	.69	.70	.71	.72	.73	.74	.75	.76								
Average for year [p]	.60	.61	.63	.66	.69	.72	.75	.78	.82	.85	.88	.91	.95	.98	1.02	1.06	1.09								
Average for year [q]	.60	.62	.64	.67	.71	.75	.79	.82	.86	.90	.94	.98	1.02	1.07	1.12	1.17	1.22								
1924																									
Jan. 22	.85	.86	.87	.88	.89	.90	.91	.92	.93	.94	.95	.96	.97	.98	.99	1.00	1.01								
Feb. 5	1.00	1.01	1.02	1.03	1.05	1.07	1.10	1.13	1.16	1.19	1.22	1.25	1.28	1.31	1.34	1.37	1.40								
Sept. 24	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------		$1.40	$1.46	$1.52	$1.58	$1.64	$1.70	$1.76	$1.82
Average for year	.97	.98	.99	1.00	1.02	1.04	1.07	1.10	1.12	1.15	1.18	1.21	1.24	1.26	1.29	1.32		1.35	1.36	1.38	1.40	1.41	1.43	1.45	1.46

[o] Standard Oil Co. (California).

[p] Los Angeles and Orange County fields only.

[q] San Joaquin Valley and Whittier-Fullerton fields.

WELLS

The approximate number of producing oil wells in the United States on December 31, 1923 and 1924, and the average production per well per day are shown in the following table, which is based on reports of companies that operate gathering lines.

Approximate number of producing oil wells in the United States, December 31, 1923–24

State	1923		1924	
	Approximate number of wells	Average production per well per day (barrels)	Approximate number of wells	Average production per well per day (barrels)
Arkansas	1,970	46.0	3,050	33.5
California	[a] 9,396	74.9	[a] 11,320	53.6
Colorado	60	3.5	70	25.8
Illinois	16,674	1.3	16,400	1.2
Indiana:				
Southwestern	1,050	1.8	1,020	1.5
Northeastern	1,250	.5	1,120	.5
Total Indiana	2,300	1.1	2,140	1.0
Kansas	17,750	4.2	18,000	4.0
Kentucky	11,700	1.7	12,450	1.5
Louisiana:				
Gulf coast	130	48.1	200	37.4
Northern	3,500	14.6	3,350	13.7
Total Louisiana	3,630	15.8	3,550	15.0
Montana	280	20.5	380	18.9
New York	14,640	.3	15,000	.3
Ohio:				
Central and eastern	20,650	0.6	20,900	0.6
Northwestern	18,900	.3	18,000	.3
Total Ohio	39,550	.5	38,900	.5
Oklahoma	57,500	6.9	60,500	8.1
Pennsylvania	74,000	.3	74,350	.3
Texas:				
Gulf coast	2,270	32.1	2,220	28.2
Rest of State	15,980	17.4	18,130	15.9
Total Texas	18,250	19.3	20,350	17.2
West Virginia	20,100	.8	20,000	.8
Wyoming	2,300	59.7	2,570	26.9
Other	([b])	([b])	[c] 70	--------
Grand total	290,100	6.6	299,100	6.2

[a] American Petroleum Institute; does not include wells temporarily shut in.
[b] Figures not available.
[c] Alaska, New Mexico, Tennessee, and Utah.

From 1859 to 1924 approximately 661,679 wells were drilled for oil and gas in the United States, of which 129,875, or 20 per cent, were dry holes. The following table summarizes results for 1859 to 1907 and gives the total completions and dry holes, by years, from 1908 to 1924.

Wells drilled for oil and gas in the United States, 1859–1924

Year	Wells completed	Dry holes	Year	Wells completed	Dry holes	Year	Wells completed	Dry holes
1859–1907	[a] 287,922	[a] 54,940	1914	23,137	4,142	1921	21,937	5,160
1908	16,909	3,214	1915	14,157	2,981	1922	24,689	5,332
1909	18,327	3,404	1916	24,619	4,039	1923	24,438	5,883
1910	14,940	2,422	1917	23,407	4,851	1924	21,888	5,044
1911	13,768	2,363	1918	25,687	5,613			
1912	17,180	2,855	1919	29,173	5,986		661,679	129,875
1913	25,590	4,282	1920	33,911	7,364			

[a] From Papers on the Conservation of Mineral Resources, U. S. Geol. Survey Bull. 394, 1909, pp. 30–50.

In 1924, the number of wells drilled for oil and gas in the United States (exclusive of dry gas wells and dry holes in California, for which figures are not available) was 21,888, which was 2,550 less than in 1923 and 12,023 less than in the record year 1920. Of the total number of wells drilled in 1924, 67 per cent were oil wells; 10 per cent, gas wells; and 23 per cent, dry holes.

As in preceding years, the rate of drilling, as shown by the number of completions (completed wells drilled for oil and gas, including dry holes) varied approximately with variations in the price of crude oil. The higher prices in the early part of the year were reflected in the completions, which increased from 1,263 in January to 2,384 in May, after which they decreased and in December were 1,685.

Wells drilled for oil and gas in the United States, 1923–24, by months [a]

	January	February	March	April	May	June	July	August	September	October	November	December	Total
1923													
Oil	1,215	1,093	1,239	1,525	1,875	1,836	1,717	1,469	1,240	1,114	989	894	16,206
Gas	236	165	168	207	171	181	209	216	181	185	213	217	2,349
Dry	505	455	482	505	572	566	619	605	466	401	359	348	5,883
	1,956	1,713	1,889	2,237	2,618	2,583	2,545	2,290	1,887	1,700	1,561	1,459	24,438
1924													
Oil	774	904	1,088	1,429	1,657	1,531	1,593	1,389	1,126	1,082	1,007	1,007	14,587
Gas	202	161	192	197	185	181	152	191	170	182	231	213	2,257
Dry	287	357	375	434	542	457	492	441	397	374	423	465	5,044
	1,263	1,422	1,655	2,060	2,384	2,169	2,237	2,021	1,693	1,638	1,661	1,685	21,888

[a] California dry gas wells and dry holes not reported.

Wells drilled for oil and gas in the United States, 1924, by States and by counties or districts [a]

	Oil	Gas	Dry	Total	Estimated average initial daily production per well (barrels)
Arkansas:					
Nevada County (Irma district)	14	1	6	21	93
Ouachita County (Smackover district)	526	15	32	573	98
Stephens district (Columbia and Ouachita Counties)	43	----------	3	46	24
Union County (El Dorado and Smackover districts)	568	33	80	681	269
Miscellaneous	1	----------	63	64	125
	1,152	49	184	1,385	179
Total, 1923	1,354	85	230	1,669	615
California:					
Coalinga	14	([b])	([b])	14	62
Coyote	3	([b])	([b])	3	725
Dominguez	41	([b])	([b])	41	2,124
Elk Hills	54	([b])	([b])	54	362

[a] For States east of California, Oil and Gas Journal; for California, American Petroleum Institute.

[b] California dry gas wells and dry holes not reported.

Wells drilled for oil and gas in the United States, 1924, by States and by counties or districts—Continued

	Oil	Gas	Dry	Total	Estimated average initial daily production per well (barrels)
California—Continued.					
Fullerton	2	([b])	([b])	2	170
Huntington Beach	55	([b])	([b])	55	187
Inglewood	2	([b])	([b])	2	183
Kern River	10	([b])	([b])	10	24
Long Beach	195	([b])	([b])	195	590
McKittrick	2	([b])	([b])	2	25
Midway-Sunset	191	([b])	([b])	191	269
Montebello	7	([b])	([b])	7	191
Richfield	7	([b])	([b])	7	279
Rosecrans	21	([b])	([b])	21	825
Santa Fe Springs	75	([b])	([b])	75	288
Torrance	531	([b])	([b])	531	319
Ventura-Newhall	21	([b])	([b])	21	423
Wheeler Ridge	7	([b])	([b])	7	183
	1,238	([b])	([b])	1,238	411
Total, 1923	980	([b])	([b])	980	1,404
Colorado:					
Florence	1			1	50
Fort Collins	1	2		3	2,000
Moffat	2		2	4	3,640
Miscellaneous			3	3	
	4	2	5	11	2,333
Total, 1923	1	1		2	500
Illinois:					
Clark	46	2	8	56	37
Clinton			1	1	
Crawford	14		8	22	4
Cumberland			2	2	
Douglas			1	1	
Edgar	1		1	2	2
Fayette			1	1	
Jackson	2			2	15
Jefferson			1	1	
Lawrence	9		2	11	11
Marion	4		2	6	48
Monroe	3		2	5	27
Wabash	35		22	57	83
Miscellaneous	2		4	6	8
	116	2	55	173	44
Total, 1923	148	18	94	260	34
Indiana:					
Northeastern—					
Adams	4			4	9
Jay	53	3	10	66	50
Randolph	2		2	4	13
Wells	2		2	4	25
Miscellaneous	7	2	5	14	17
	68	5	19	92	43
Total, 1923	82	1	14	97	43
Southwestern—					
Gibson	11		8	19	33
Pike	7		4	11	18
Sullivan	2	4	8	14	14
Miscellaneous	5	2	7	14	9
	25	6	27	58	22
Total, 1923	40	3	35	78	23
Total Indiana, 1924	93	11	46	150	37
1923	122	4	49	175	36

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[b] California dry gas wells and dry holes not reported.

Wells drilled for oil and gas in the United States, 1924, by States and by counties or districts—Continued

	Oil	Gas	Dry	Total	Estimated average initial daily production per well (barrels)
Kansas:					
Butler	13	1	27	41	41
Chatauqua-Elk	19	25	33	77	98
Cowley	62	15	35	112	440
Greenwood-Woodson	329	5	93	427	120
Marion	7		10	17	85
Miami-Franklin-Anderson	115	3	34	152	53
Montgomery-Wilson	58	15	44	117	217
Neosho-Allen	26	7	44	77	54
Rice	2		3	5	128
Russell	8		9	17	235
Miscellaneous	11	8	64	83	60
	650	79	396	1, 125	143
Total, 1923	807	63	535	1, 405	76
Kentucky:					
Allen	157		96	253	25
Barren	186	8	35	229	9
Cumberland-Monroe	45		75	120	99
Johnson-Magoffin-Lawrence	326	10	3	339	20
Lee-Owsley	118	13	10	141	30
Owensboro	75	1	29	105	11
Warren	155	2	41	198	20
Miscellaneous	114	27	79	220	16
	1, 176	61	368	1, 605	22
Total, 1923	1, 392	80	471	1, 943	24
Louisiana:					
Gulf coast—					
Edgerley	14		3	17	83
Jennings	11		16	27	196
Lockport	1		3	4	3, 000
Vinton	51		18	69	151
Miscellaneous	1		8	9	60
	78		48	126	180
Total, 1923	87		33	120	114
Northern—					
Bellevue	69	1	13	83	26
Caddo	29	2	11	42	192
Claiborne	2		4	6	35
Cotton Valley	43	19	4	66	1, 420
Red River			2	2	
Miscellaneous	3	142	79	224	173
	146	164	113	423	458
Total, 1923	201	143	137	481	93
Total Louisiana, 1924	224	164	161	549	362
1923	288	143	170	601	99
Montana:					
Cat Creek	6	1	4	11	208
Kevin-Sunburst	96	4	38	138	244
Miscellaneous	2	3	16	21	1, 538
	104	8	58	170	267
Total, 1923	162	11	75	248	91
New Mexico:					
Artesia	4			4	61
Hogback	5			5	409
Rattlesnake	2			2	8
Miscellaneous			2	2	
	11		2	13	210
Total, 1923	(c)	(c)	(c)	(c)	(c)

[c] Included under "Other States."

Wells drilled for oil and gas in the United States, 1924, by States and by counties or districts—Continued

	Oil	Gas	Dry	Total	Estimated average initial daily production per well (barrels)
Ohio:					
Central and eastern—					
Hocking	45	14	21	80	51
Holmes	49	84	23	156	29
Knox	32	18	11	61	3
Licking	113	20	19	152	16
Monroe	24	7	19	50	7
Morgan	63	----------	9	72	25
Muskingum	3	----------	2	5	52
Noble	42	5	45	92	2
Perry	26	3	8	37	5
Washington	87	16	43	146	5
Wayne	35	72	29	136	25
Miscellaneous	137	280	147	564	9
	656	519	376	1,551	16
Total, 1923	688	469	462	1,619	13
Northwestern—					
Allen	34	1	2	37	13
Auglaize	32	----------	3	35	21
Darke	22	----------	5	27	16
Hancock	51	6	2	59	23
Lucas	----------	3	1	4	----------
Mercer	85	6	13	104	12
Ottawa	58	----------	3	61	28
Sandusky	12	----------	----------	12	8
Seneca	3	----------	6	9	158
Van Wert	17	1	1	19	22
Wood	122	1	16	139	15
Miscellaneous	51	24	11	86	33
	487	42	63	592	20
Total, 1923	605	17	75	697	22
Total Ohio, 1924	1,143	561	439	2,143	17
1923	1,293	486	537	2,316	17
Oklahoma:					
Carter	286	31	60	377	148
Creek	323	48	144	515	288
Garfield-Noble	137	11	24	172	447
Kay	327	23	49	399	813
Lincoln	47	4	10	61	748
Muskogee-Wagoner	74	37	151	262	53
Nowata-Rogers	30	10	27	67	21
Okfuskee-Hughes-McIntosh-Seminole	452	56	133	641	760
Okmulgee	188	51	171	410	112
Osage	770	63	173	1,006	370
Pawnee	93	10	33	136	225
Payne	10	4	9	23	110
Stephens-Cotton	78	35	68	181	29
Tulsa	151	40	107	298	201
Washington	29	7	18	54	21
Miscellaneous	43	38	131	212	104
	3,038	468	1,308	4,814	399
Total, 1923	3,515	587	1,731	5,833	364
Pennsylvania and New York:					
Allegany	286	----------	3	289	2
Bradford	1,005	2	46	1,053	2
Butler-Armstrong	99	21	37	157	3
Middle Field	55	7	11	73	3
Venango-Clarion	355	44	29	428	1
Southwestern Pennsylvania—					
Allegheny County	26	30	18	74	5
Beaver County	10	----------	6	16	1
Greene County	13	60	13	86	9
Washington County	9	13	5	27	15
Westmoreland County	----------	----------	1	1	----------
	1,858	177	169	2,204	2
Total, 1923	1,959	243	220	2,422	4

Wells drilled for oil and gas in the United States, 1924, by States and by counties or districts—Continued

	Oil	Gas	Dry	Total	Estimated average initial daily production per well (barrels)
Tennessee:					
Clay	8		11	19	144
Morgan	1			1	50
Miscellaneous			8	8	
	9		19	28	133
Total, 1923	([c])	([c])	([c])	([c])	([c])
Texas:					
Gulf coast—					
Barbers Hill	1		2	3	1,000
Batson	63		17	80	92
Big Creek	10		7	17	512
Blue Ridge	7		4	11	681
Damon Mound	6		10	16	28
Goose Creek	84		35	119	201
Hull	116		45	161	1,538
Humble	26		11	37	706
Markham	3		4	7	703
Orange	105		47	152	1,667
Pierce Junction	3		8	11	208
Saratoga	21		15	36	20
Sourlake	28		24	52	94
Spindletop	27		9	36	55
West Columbia	21		7	28	526
Miscellaneous	23		47	70	98
	544		292	836	783
Total, 1923	638		374	1,012	532
Rest of State—					
Archer County	854		389	1,243	153
Calliham	34	18	14	66	91
Eastland County	110	16	68	194	51
Jim Hogg County	6			6	1,017
Luling	135	9	12	156	1,391
Milam County	35	2	9	46	21
Navarro County	267	5	90	362	707
Reagan County	10		6	16	1,396
Shackelford County	13		7	20	143
Somerset	13	1	2	16	16
Stephens County	120	13	55	188	178
Webb and Zapata Counties	107	13	14	134	152
Wichita County	421		253	674	77
Wortham	13		1	14	6,665
Young County	29	2	79	110	54
Miscellaneous	139	49	271	459	146
	2,306	128	1,270	3,704	311
Total, 1923	2,751	84	1,079	3,914	685
Total Texas, 1924	2,850	128	1,562	4,540	401
1923	3,389	84	1,453	4,926	656
West Virginia:					
Braxton	1	16	19	36	5
Doddridge	35	28	19	82	19
Gilmer	17	45	9	71	6
Kanawha	9	55	3	67	12
Lincoln	2	61		63	3
Marion	10	23	7	40	8
Marshall	17	17	2	36	11
Pleasants	34	6	18	58	5
Ritchie	58	79	55	192	11
Roane	10	16	7	33	2
Wetzel and Tyler	29	25	30	84	32
Wirt	17		6	23	2
Wood	26	3	13	42	6
Miscellaneous	57	148	30	235	21
	322	522	218	1,062	11
Total, 1923	404	503	222	1,129	10

[c] Included under "Other States."

Wells drilled for oil and gas in the United States, 1924, by States and by counties or districts—Continued

	Oil	Gas	Dry	Total	Estimated average initial daily production per well (barrels)
Wyoming:					
Big Horn Basin	13	1	5	19	158
Big Muddy	1			1	172
Fremont County	3	2	4	9	60
Lance Creek	4		3	7	1,104
Lost Soldier district and Carbon County	20	12	14	46	454
Natrona County	3	1	4	8	142
Osage	15			15	20
Rock Creek	7		1	8	130
Salt Creek	529	1	8	538	180
Miscellaneous	4	5	4	13	25
	599	22	43	664	188
Total, 1923	374	37	40	451	338
Other States [d], 1924		3	11	14	
1923	18	4	56	78	
United States, 1924	14,587	[b] 2,257	[b] 5,044	[b] 21,888	
1923	16,206	[b] 2,349	[b] 5,883	[b] 24,438	

[b] California dry gas wells and dry holes not reported.
[d] 1923: New Mexico, Tennessee, and Utah; 1924: Alabama, Mississippi, and Utah.

SPECIFIC GRAVITY OF CRUDE PETROLEUM

The accompanying table gives the estimated average specific gravity of the crude petroleum produced in certain fields and districts, as reported by pipe-line and producing companies. The equivalents of "degrees A. P. I." in decimals representing specific gravity are taken from "National standard petroleum oil tables" (Circular 154 of the Bureau of Standards).

Estimated average specific gravity of crude petroleum from certain fields, 1924

District or grade	Degrees A. P. I.	Specific gravity
Alaska: Katalla	44.0	0.806
Arkansas:		
El Dorado	34.0	.855
Irma	14.2	.971
Smackover, light (range 24–29)	25.0	.904
Smackover, heavy (range 16–23.9)	20.0	.934
Stephens	31.0	.871
California:		
Coalinga	18.9	.941
Coyote	24.3	.908
Dominguez	32.4	.863
Elk Hills	22.5	.919
Huntington Beach	25.6	.901
Inglewood	19.5	.937
Kern River	14.0	.973
Long Beach	25.8	.900
Los Angeles	14.8	.967
Lost Hills-Belridge	25.5	.901
McKittrick	14.8	.967
Midway-Sunset	21.7	.924
Montebello	23.2	.915
Richfield	22.7	.918
Rosecrans	33.0	.860
Santa Fe Springs	33.0	.860
Santa Maria	16.9	.954
California—Continued.		
Sargent	16.0	0.959
Summerland	13.0	.979
Torrance	20.7	.930
Ventura	30.2	.875
Wheeler Ridge	25.3	.902
Whittier	19.1	.940
Colorado:		
Florence	29.1	.881
Fort Collins	37.8	.836
Moffat	41.0	.820
Rangely	43.5	.809
Tow Creek	35.0	.850
Illinois:		
"Illinois"	33.0	.860
Plymouth	34.2	.854
Waterloo	30.0	.876
Indiana:		
Northeastern ("Indiana")	35.5	.847
Southwestern ("Princeton")	33.0	.860
Kansas:		
Augusta	34.0	.855
Eldorado	36.0	.845
Fox-Bush	39.0	.830
Iola	19.0	.940
Madison	41.0	.820

Estimated average specific gravity of crude petroleum from certain fields, 1924—Continued

District or grade	Degrees A.P.I.	Specific gravity
Kansas—Continued.		
Moran	28.0	0.887
Peabody-Elbing	35.0	.850
Rainbow	41.0	.820
Russell County	40.5	.823
Teeter	39.5	.828
Virgil	38.0	.835
Kentucky:		
Ragland	25.2	.903
Ravenna	39.0	.830
Rodemer	29.0	.882
Scottsville	35.0	.850
Somerset (light)	39.0	.830
Somerset (medium)	35.5	.847
Warren County	36.0	.845
Louisiana:		
Bellevue	19.0	.940
Bull Bayou	39.5	.828
Caddo (light)	39.5	.828
Caddo (heavy)	23.0	.916
Cotton Valley	29.0	.882
De Soto	40.5	.823
Edgerley	21.0	.928
Elm Grove	30.5	.874
Haynesville	35.0	.850
Homer	36.0	.845
Jennings	24.5	.907
Lockport	24.5	.907
Vinton	20.0	.934
Montana:		
Cat Creek	49.0	.784
Elk Basin	43.0	.811
Kevin-Sunburst	32.0	.865
Soap Creek	19.7	.936
New Mexico:		
Artesia	36.0	.845
Hogback	56.0	.755
Rattlesnake	64.8	.721
New York	42.0	.816
Ohio:		
Cleveland	38.2	.834
Corning	42.0	.816
Lima	36.3	.843
"Pennsylvania" (Macksburg)	42.5	.813
Wooster	38.1	.834
Oklahoma:		
Billings	41.0	.820
Blackwell	39.2	.829
Bristow	33.0	.860
Burbank	38.0	.835
Cement	31.0	.871
Cleveland	37.5	.837
Cromwell	37.0	.840
Cushing	39.0	.830
Duncan	36.0	.845
Fox	21.7	.924
Garber	43.0	.811
Glenn	34.0	.855
Healdton	29.5	.879
Hewitt	34.0	.855
Keywest	41.5	.818
Lyons	39.5	.828
Papoose	38.5	.832
Ponca	40.0	.825
Tonkawa	42.0	.816
Walters	31.0	.871
Wewoka	37.5	.837
Wheeler	21.7	.924
Pennsylvania:		
Franklin	29.5	0.879
"Pennsylvania"	42.0	.816
Tennessee:		
Glen Mary	39.5	.830
Tinsleys Bottom	43.2	.810
Texas:		
Batson	20.6	.930
Big Creek	24.0	.910
Big Lake	37.6	.837
Breckenridge	38.0	.835
Burkburnett	38.0	.835
Calliham	18.0	.947
Carson County	36.0	.845
Currie	42.0	.816
Damon Mound	21.5	.925
Dayton	20.5	.931
Electra	40.0	.825
Goose Creek	24.0	.910
High Island	30.0	.876
Holliday	39.0	.830
Hull	22.5	.919
Humble	23.0	.916
Luling	28.0	.887
Lytton Springs	38.0	.835
Mexia	36.5	.842
Minerva	38.0	.835
Mirando	20.0	.934
Orange	22.7	.918
Pierce Junction	23.5	.913
Pioneer	41.5	.818
Powell	37.5	.837
Ranger	37.5	.837
Richland	38.0	.835
Saratoga	19.0	.940
Somerset	33.0	.860
Sourlake	21.7	.924
South Liberty	20.5	.931
Spindletop	22.5	.919
Swastika	40.0	.825
Westbrook	25.0	.904
West Columbia	22.8	.917
Wortham	38.5	.832
West Virginia:		
Cabell	39.3	.829
Cabin Creek	48.0	.788
Kellys Creek	45.0	.802
"Pennsylvania"	43.0	.811
Volcano	29.0	.882
Wyoming:		
Big Muddy	33.0	.860
Byron	41.0	.820
Elk Basin	43.0	.811
Grass Creek (light)	45.0	.802
Grass Creek (heavy)	21.0	.928
Greybull-Torchlight	45.0	.802
Hamilton Dome	25.0	.904
Lance Creek	42.0	.816
Lander	23.0	.916
Lost Soldier	31.5	.868
Notches	23.0	.916
Pilot Butte	33.0	.860
Poison Spider	15.0	.966
Rex Lake	32.3	.864
Rock Creek	37.4	.838
Salt Creek	37.0	.840
Teapot	36.4	.843

PRODUCTION OF PETROLEUM AND ROYALTIES FROM WELLS UNDER FEDERAL CONTROL

The following tables have been compiled from data received by the Bureau of Mines and by the Office of Indian Affairs:

Crude petroleum produced on Government lands, 1923-24, under the operation of the leasing act of February 25, 1920

State and land office	1923			1924		
	Production (barrels)	Royalty		Production (barrels)	Royalty	
		Barrels	Value		Barrels	Value
California:						
Los Angeles	1, 506, 453. 94	176, 281. 22	$183, 457. 61	1, 483, 772. 66	173, 913. 17	$191, 647. 65
Visalia, outside naval reserves	2, 818, 166. 66	403, 523. 66	279, 972. 15	4, 900, 671. 10	633, 096. 12	653, 483. 86
Visalia, inside naval reserves	10, 290, 460. 51	2, 384, 667. 99	1, 939, 011. 11	12, 028, 336. 16	2, 973, 508. 72	3, 241, 465. 90
	14, 615, 081. 11	2, 964, 472. 87	2, 402, 440. 87	18, 412, 779. 92	3, 780, 518. 01	4, 086, 597. 41
Colorado: Glenwood Springs	1, 496. 05	299. 20	305. 74	270, 004. 53	27, 370. 87	28, 950. 25
Louisiana: Baton Rouge				1, 223. 17	152. 89	219. 22
Montana:						
Great Falls	10, 467. 77	523. 39	534. 52	253, 422. 24	14, 837. 68	14, 917. 65
Lewistown	1, 747, 279. 40	119, 887. 91	285, 868. 16	1, 260, 675. 67	71, 561. 74	154, 653. 93
	1, 757, 747. 17	120, 411. 30	286, 402. 68	1, 514, 097. 91	86, 399. 42	169, 571. 58
Wyoming:						
Cheyenne	128, 284. 25	9, 875. 08	8, 230. 56	60, 053. 35	3, 081. 02	2, 952. 18
Douglas, outside naval reserves	29, 896, 479. 09	6, 616, 050. 88	10, 687, 166. 43	26, 803, 870. 11	5, 454, 464. 18	9, 075, 766. 64
Douglas, inside naval reserves	1, 136, 948. 28	177, 686. 93	270, 046. 53	1, 003, 757. 19	128, 212. 29	204, 097. 56
Evanston				1, 129. 00	166. 25	324. 51
Lander	397, 919. 75	50, 918. 20	73, 913. 55	487, 507. 39	61, 867. 91	92, 783. 86
Newcastle	67, 461. 88	8, 537. 19	13, 560. 53	58, 176. 61	7, 312. 06	11, 176. 65
	31, 627, 093. 25	6, 863, 068. 28	11, 052, 917. 60	28, 414, 493. 65	5, 655, 103. 71	9, 387, 101. 40
	48, 001, 417. 58	9, 948, 251. 65	13, 742, 066. 89	48, 612, 599. 18	9, 549, 544. 90	13,672,439.86

Royalty receipts from production of oil and gas and bonuses paid for sale of leases on Indian reservations, fiscal years ended June 30, 1923–24

[From Office of Indian Affairs]

Reservation	1923			1924		
	Oil and gas land leased during year (acres)	Receipts		Oil and gas land leased during year (acres)	Receipts	
		Bonus from sale of leases	Royalty from production		Bonus from sale of leases	Royalty from production
Five Civilized Tribes:						
Oil	197, 540	$1, 084, 798	$3, 155, 454	111, 582	$242, 989	$2, 302, 767
Gas			133, 226			128, 038
Crow: Oil				3, 138	157	245
Kiowa:						
Oil	13, 238		22, 788	43, 285	42, 059	11, 102
Gas						1, 563
Osage:						
Oil	47, 711	15, 671, 404	13, 048, 878	51, 142	11, 804, 104	10, 776, 307
Gas			1, 023, 664			
Pawnee:						
Oil	4, 352	45, 856	123, 489	2, 758	11, 326	271, 733
Gas						7, 813
Ponca and Otoe:						
Oil	10, 067	25, 594	63, 983	623	13, 724	53, 865
Gas						1, 164
Seger: Oil				1, 840	3, 295	
Shawnee:						
Oil		24, 956	7, 869	8, 214	16, 552	7, 569
Gas						
Shoshone: Oil	5, 560	13, 051	6, 394	6, 224	11, 726	6, 110
	278, 468	16, 865, 659	17, 585, 745	228, 806	12, 145, 932	13, 568, 276

SUMMARY OF REFINERY STATISTICS

The following table has been compiled from the petroleum refinery statistics published monthly by the Bureau of Mines.

Refinery statistics, 1918–1924

[Thousands of barrels of 42 U. S. gallons except as otherwise indicated]

	1918	1919	1920	1921	1922	1923	1924
Crude oil (domestic and foreign) run to stills	326, 025	361, 520	433, 915	443, 363	500, 706	581, 238	643, 719
Natural-gas gasoline run to stills or blended at refineries	2, 451	2, 957	3, 153	2, 517	3, 662	5, 487	12, 671
Stocks of crude oil (domestic and foreign) at refineries at end of year	15, 750	13, 143	21, 261	26, 562	33, 805	33, 259	40, 995
Gasoline:							
Produced	85, 007	94, 235	116, 251	122, 704	147, 672	179, 903	213, 326
Imported	307	203	964	900	1, 479	4, 555	3, 453
Exported[a]	13, 545	9, 098	15, 637	13, 134	14, 157	20, 736	28, 967
Consumed	74, 505	81, 782	101, 207	107, 525	127, 905	156, 751	185, 003
Stocks at refineries at end of year	7, 080	10, 638	11, 009	13, 954	21, 043	28, 014	30, 823
Kerosene:							
Produced	43, 461	55, 753	55, 240	46, 313	54, 913	55, 927	60, 026
Imported	([b])	([b])	([b])	([b])	[c] 3	7	10
Exported[a]	11, 820	23, 537	20, 878	18, 016	21, 489	20, 347	21, 961
Consumed	34, 443	33, 187	33, 082	29, 537	34, 854	35, 048	36, 712
Stocks at refineries at end of year	9, 050	8, 079	9, 359	8, 119	6, 692	7, 231	8, 594
Gas and fuel oils:							
Produced	174, 319	181, 602	210, 987	230, 091	254, 910	287, 481	320, 476
Imported	([b])	([b])	([b])	([b])	[c] 2,947	12, 286	12, 927
Exported[a]	29, 637	16, 487	22, 079	22, 676	18, 479	33, 377	37, 249
Consumed	142, 750	163, 803	185, 973	195, 656	240, 010	261, 383	292, 452
Stocks at refineries at end of year	15, 691	17, 003	19, 938	31, 697	31, 065	36, 072	39, 774
Lubricants:							
Produced	20, 035	20, 161	24, 938	20, 896	23, 304	26, 128	27, 498
Imported	([b])	([b])	([b])	([b])	[c] 43	29	11
Exported[a]	6, 165	6, 598	9, 643	6, 937	7, 940	8, 371	9, 103
Consumed	13, 823	13, 600	14, 742	12, 046	15, 529	17, 261	18, 124
Stocks at refineries at end of year	3, 306	3, 269	3, 822	5, 735	5, 613	6, 138	6, 420
Wax (thousands of pounds):							
Produced	505, 144	467, 235	541, 204	434, 884	462, 003	466, 647	516, 491
Stocks at refineries at end of year	199, 658	222, 462	195, 368	207, 563	204, 891	164, 758	89, 706
Coke (short tons):							
Produced	559, 663	603, 459	576, 613	604, 465	707, 064	672, 526	761, 095
Stocks at refineries at end of year	22, 605	21, 146	31, 469	74, 508	35, 722	26, 264	97, 844
Asphalt (short tons):							
Produced[d]	607, 968	901, 885	1, 290, 614	1, 214, 536	1, 895, 257	2, 327, 116	2, 545, 573
Stocks at refineries at end of year	76, 858	73, 449	81, 097	98, 330	119, 648	118, 090	97, 259

[a] Including shipments to Alaska, Hawaii, and Porto Rico.
[b] No data available prior to change in tariff, Sept. 22, 1922.
[c] Sept. 22 to Dec. 31.
[d] Figures for production of asphalt given here were compiled by the Bureau of Mines prior to consolidation with Division of Mineral Resources of the Geological Survey, and they differ from those given for sales in the chapter on asphalt.

MOTOR FUEL

The approximate quantity of motor fuel produced in the United States can be computed by adding the production of gasoline at petroleum refineries (including naphthas and other products lighter than kerosene), the production of benzol by the coke industry, and the production of raw natural-gas gasoline, making allowance for the raw natural-gas gasoline blended at petroleum refineries (which is included in the figures of refinery production of gasoline) and deducting the raw natural-gas gasoline which is run into crude-petroleum pipe lines and mixed with the oil that goes to refineries to be distilled. Approximate production for the years 1918 to 1924, computed as above, appears in the following table:

Approximate production of motor fuel in the United States, 1918–1924

[Thousands of barrels of 42 U. S. gallons]

	1918	1919	1920	1921	1922	1923	1924
Gasoline, including naphthas and other products lighter than kerosene, produced at refineries	85,007	94,235	116,251	122,704	147,672	179,903	213,326
Raw natural-gas gasoline blended at refineries	2,451	2,957	3,153	2,517	3,662	5,487	12,671
Raw natural-gas gasoline turned into crude oil pipe lines (to be recovered by distillation)	(a)	(a)	(a)	(a)	(a)	1,775	2,131
Raw natural-gas gasoline produced	6,727	8,370	9,161	10,713	12,044	19,434	22,235
Benzol produced by the coke industry	1,067	1,454	1,985	1,297	1,669	2,318	2,188
Motor fuel produced	90,350	101,102	124,244	132,197	157,723	194,393	222,947
Percentage of raw natural-gas gasoline to total motor fuel produced	7.4	8.3	7.4	8.1	7.6	10.0	10.0

[a] Data not available.

The ratio of the production of raw natural-gas gasoline to the total motor fuel produced has increased from 7 per cent in 1918 to 10 per cent in 1924. Before 1925, data were not compiled showing the quantity of gasoline produced by cracking processes, but figures covering the first few months of 1925 indicate that approximately 25 per cent of the total output of motor fuel is made by cracking; about 64 per cent of the total by straight-run processes of manufacture from petroleum; 10 per cent from natural-gas gasoline; and about 1 per cent from benzol.

OIL SHALE AND SHALE OIL

Production of shale oil in the United States in 1924 was reported from three plants, two in California and one in Nevada, whose total output was 600,000 gallons. This figure contrasts with a production of 292,000 gallons from the same three plants in 1923. The crude shale oil produced in California[13] was not refined but was consumed as fuel oil and used for mineral flotation in ore-concentrating mills, whereas the entire output of shale oil in Nevada is reported to have been run through the refinery at Elko. The products of this refinery are gasoline, lubricants, fuel oils, wax, and asphalt, which are sold locally and shipped to several States and to the Orient.

The operations of the Catlin plant at Elko, Nev., concerning which few details have been made public, are briefly described by the superintendent of the plant, W. L. Sheeler, in the Railroad Red Book for January, 1925, from which the following is taken:

> The Catlin Shale Products Co.'s present plant is the result of many years' experimentation by Robert M. Catlin. For the past eight years, five different processes were tried out with commercial-sized units. The process that has been working for the past two years was evolved from this experimentation. The

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[13] The shale oil produced in California comes from an oil-saturated diatomaceous shale.

idea in view was not the many by-products which are known to be derived from the oil shales and which at the present time are not commercially feasible, unless the main product "oil" is extracted first. It was to evolve a process to treat oil shales in mass, in a retort having large capacity, few working parts, low maintenance and operating expenses, along with simplicity of operation. A process such as this is only evolved by using units of commercial size, and continuously operated. The retort is a vertical blast furnace type, steel shell, lined with fire bricks, with an initial charging capacity of 80 tons. Once charged and the fire lighted the operation is continuous, charging of raw shale being done, as needed, from a supply hopper on top of the retort. The shale is crushed to 2-inch size by a single-roll Jeffery crusher. The heat necessary to free the oil vapors from the shale is supplied by the combustion of the carbon left in the shale after the oil is extracted. Three distinct zones of reaction are maintained inside of the retort—ash, fire, and distillation. As fast as the oil is freed from the shale in the distilling zone, the carbon residue remaining travels to the fire zone. The fire zone, supplying the necessary heat for the rapid distillation of the shale above, is controlled at will by an admixture of gas and air, which is circulated in large volume through the fire zone and thence through the retort. Combustion of carbon in the fire zone is controlled by the amount of oxygen in circulating gases. The circulating gases act as a scavenger for the oil vapors being distilled, as well as a medium for controlling fire and transferring heat to the shale being distilled in the distillation zone. After the needed amount of carbon for combustion is utilized, the spent shale is cut out automatically by grates into the ash pit below, where it is discharged into cars and hauled to the spent shale dump.

The oil vapors evolved during the process of distillation are taken off through an outlet pipe at the top of the retort and into the condensing system, where they are condensed into oil by water condensers, and Cottrell unit. The uncondensable gases are piped to a combustion chamber where they are burned, the resultant heat therefrom being transferred to the boilers which supply the necessary steam for the plant.

The throughput of the one unit in operation has been as high as 144 tons in 24 hours. It has been in operation for two years with no repairs necessary for its constant operation. A complete refinery is operated in conjunction with the retort. This consists of three 250-barrel oil stills, agitators, complete wax plant, filter house, tank farm, and all other appurtenances necessary to market finished products. The lubricating oil being made from the Elko shales has demonstrated, through use over an extended period, its superiority in aeroplanes, automobiles, and other lubrication; also that shale oil does lubricate.

The California plants are described in the following papers: "Oil shale in Santa Barbara County, Calif.," by F. D. Gore, Bulletin of the American Association of Petroleum Geologists, vol. 8, 1924, pages 459–472, and in "Making shale oil in California," by George W. Wallace, in Chemical and Metallurgical Engineering, vol. 32, 1925, pages 237–240.

Oil produced from shale by distillation in the United States, 1923–24, by States

State	Number of plants reported	Crude oil produced (gallons)	Average specific gravity of crude oil	Average recovery of oil (gallons per ton of shale treated, estimate)	Oil shale treated for extraction of shale oil, estimate (short tons)
1923					
California	2	160,000	0.913 (17°)	30	5,300
Nevada	1	132,000	.920 (22.3°)	26	5,000
	3	292,000	--------------	28	10,300
1924					
California	2	210,000	.966 (15°)	27	7,800
Nevada	1	390,000	.922 (22°)	25	15,600
	3	600,000	--------------	26	23,400

World's production of oil shale, 1920–1924, in metric tons [a]

Country	1920	1921	1922	1923	1924
Australia:					
New South Wales	21,341	33,009	23,844	1,226	652
Tasmania	142	882	41	1,119	1,601
Esthonia	46,111	95,514	138,922	214,099	233,631
France	69,000	64,693	61,000	62,142	(b)
Italy	16,325	3,030	5,476	5,662	2,987
Russia	30,366	19,300	18,500	24,200	(b)
Spain	(c)	(c)	(c)	(c)	(c)
Sweden	-----	(d)	(d)	(d)	(b)
United Kingdom:					
England	1,750	-----	-----	71	-----
Scotland	2,886,455	1,896,860	2,645,790	2,906,475	2,902,960
United States	(b)	(b)	(b)	[e] 9,300	[e] 21,200

[a] Compiled by L. M. Jones, of the Bureau of Mines.

[b] Data not available.

[c] There is in operation in Puertollano a plant for the treatment of oil shale and impure coal to obtain oil, but no details of production are available.

[d] Data on production of oil shale not available; the following quantities of shale oil were extracted from alum shale: 1921, 328 metric tons; 1922, 353 tons; 1923, 158 tons.

[e] Estimated. Used in production of shale oil.

COAL

By James E. Black, L. Mann, and F. G. Tryon

INTRODUCTION

GENERAL STATEMENT

The issuance of this report, containing information for the calendar year 1924, marks the forty-third consecutive year in which detailed records of coal production have been made available. Many of the basic data have already been issued in the weekly coal reports of the Bureau of Mines. The statistics in this report are not accompanied by a descriptive text, as in previous numbers of the series, because urgent calls upon the small staff engaged in the work for assistance to other agencies interested in coal and its allied products have taken up the time necessary for the preparation of the usual discussion. This deviation, the bureau believes, will not materially lessen the value of the 1924 report because elaborate analyses were presented in the 1922 and 1923 editions. The explanatory comments in the reports for those years are equally applicable to the statistical material of 1924. Persons desiring a more exhaustive explanation of the meaning and purpose of the historical tables which follow should familiarize themselves with the 1923 edition, the order and continuity of which are closely followed herein. The tables throughout have been grouped by subjects, as indicated by center headings.

UNITS OF MEASUREMENT

The unit of measurement accepted as a standard in this report is the net ton of 2,000 pounds. As anthracite is mined and sold in accordance with the Pennsylvania laws by the gross ton of 2,240 pounds, that unit is used in the pages dealing with anthracite. The word "ton," therefore, unless otherwise specified, means a net ton to which all other figures, regardless of the manner in which reported, have been reduced.

ACKNOWLEDGMENTS

As the collection of material contained in the present report is almost entirely dependent upon the help of individuals and agencies engaged in the coal industry, acknowledgment of the courteous assistance and the loyal support of coal producers, coal association secretaries, railroad traffic officials, and consumers alike is a sincere pleasure. So many have graciously complied with the extended requests made upon them for information that it is impossible here to mention them all individually. Especially helpful has been the cooperation of the State geologists, the several divisions of the Bureau of Mines, and the coal traffic managers of the railroads. Special acknowledgments are due to the mine inspectors of certain States who have assisted in the collection of returns: C. H. Nesbitt, chief mine inspector of Alabama; Jesse Redyard, State mine inspector of Arkansas; Albert C. Dally, chief mine inspector of Indiana; L. E. Stamm, secretary of the Iowa mine inspectors' office; James Sherwood, chief mine inspector of Kansas; W. E. Jones, chief inspector of mines of Kentucky; Dr. John J. Rutledge, chief mine engineer of

Maryland; George N. Griffin, State coal mine inspector of Montana; A. Waddington, State coal mine inspector of North Dakota; the State Industrial Commission of Ohio; Hon. Joseph J. Walsh and Frank Hall of the Pennsylvania Department of Mines; O. P. Pile, chief mine inspector of Tennessee; and R. M. Lambie, chief of the West Virginia Department of Mines.

Miss Lida Mann, assisted by Miss J. M. Corse, conducted the compilation of the annual statistics of bituminous coal operations. Mrs. H. L. Bennit compiled the anthracite statistics. Miss R. M. McKinney prepared weekly and monthly production estimates; and Mrs. E. E. Finn prepared the three stock reports issued during the year under the supervision of W. F. McKenney. J. A. Dorsey tabulated the coal import and export figures from the records of the Bureau of Foreign and Domestic Commerce. F. G. Tryon was in charge of the work in its early stages, and during his absence on furlough James E. Black was in charge.

REVIEW OF THE COAL INDUSTRY IN 1924

BITUMINOUS COAL

In 1924 production of bituminous coal amounted to 483,687,000 tons, a decrease of some 80,000,000 tons in comparison with 1923. Consumption declined less than production. In 1923 some 26,000,000 tons of the year's output flowed into storage. In 1924 the movement was reversed and 17,000,000 tons flowed out of storage to supplement current production. (Table 3.) Exclusive of exports, the coal used in continental United States in 1924 was about 484,000,000 tons as against 519,000,000 in 1923. The struggle between union and nonunion operations, which assumed noticeable proportions in 1923, became more pronounced in 1924 as the output from the nonunion areas increased and in consequence mines were closed by operators in the union districts who felt they could no longer pay the wage scale laid down in the Jacksonville agreement. The average mine value of coal, $2.20 per net ton in 1924, continued its downward tendency from the preceding year and was the lowest for any year since 1916.

As might be expected, the number of employees in 1924 was less than that in 1923. It was approximately equal to the number in 1919, when bituminous production was some 20,000,000 tons less than in 1924, a comparison that suggests increasing output per man per day. Much of this increase in the productivity of labor may be attributed to greater installation of undercutting machines, by the use of which 70 per cent of the total output in 1924 was mined.

No car shortage prevailed during 1924. None could have been expected, for production in only a few weeks, at the beginning and end of the year, exceeded the average weekly figures for 1923, when coal was shipped with only minor traffic complaints. Because of continued improvement in the facilities of the carriers and the temperate winter conditions that have prevailed in the past two years the car-shortage bogy has been almost entirely dispelled.

Largely as a result of the heavy stocks carried over from 1923, spot prices in 1924 were low. The average of 14 representative coals as calculated by Coal Age stood at $2.21 in January and $2.25 in February, and these prices were the highest during the year. The price then declined until in July it went below $2; thereafter it recovered slightly, closing the year at $2.06 per ton. The average of the Coal Age prices for the year was $2.08.

ANTHRACITE

Production of anthracite in 1924 amounted to approximately 79,000,000 gross tons, 5,000,000 tons less than was produced in 1923, and about the same as the output for 1920 and 1921, recent full-time years. The number of employees increased from 158,000 in 1923 to 160,000 in 1924. Unlike 1923, when the question of wages and labor relations was prominent and there was a short suspension of all anthracite operations, the year 1924 presented no serious labor difficulties. There were a number of local misunderstandings or "outlaw" strikes, some involving a considerable number of men. The anthracite region, as a whole, however, worked regularly under the two-year wage agreement which had been signed in September, 1923. Time lost on account of strikes in 1924 amounted to 7 days per man employed, or 10 days less than in 1923.

Of the anthracite shipped in 1924, 67,000,000 gross tons, or 98 per cent, was breaker product, the remainder being washery or dredge coal. Of these shipments three-fourths were domestic or household sizes, including pea coal. Prices in the first quarter of 1924 reflected the increase in the wage scale of September, 1923, and "company" stove coal was quoted around $9 per gross ton, f. o. b. mine, as in the last three months of 1923. "Independent" stove coal commanded a premium of about $1, but its price began to decline in February and by April 1 averaged only a little above that for company coal. With the expiration of summer discount rates, independent stove coal prices in September averaged $9.60, increasing to $10.65 per gross ton in December, or about $1.50 per gross ton higher than company quotations. The quoted prices of company steam sizes, on the contrary, remained between 75 cents and $1 per gross ton higher than those of the independents.

STATISTICAL SUMMARY

The salient statistical facts of the coal industry in 1924 are summarized in Table 1.

TABLE 1.—*Salient statistics of the coal industry in 1924*

[Figures for bituminous in net tons; anthracite in gross tons]

	Bituminous	Anthracite
Production..........tons..	483, 686, 538	78, 506, 127
Value at mines..........	$1, 062, 626, 000	$477, 231, 000
Average value per ton..	$2. 20	$6. 08
Average spot price as quoted by Coal Age..	$2. 08	([a])
Stocks of commercial consumers:		
Jan. 1..........tons..	62, 000, 000	([a])
Dec. 31..........do....	45, 000, 000	([a])
Net change during year..........tons..	−17, 000, 000	[b]+2, 955, 000
Exports..........do....	17, 100, 000	3, 587, 000
Imports..........do....	417, 000	105, 000
Consumption (calculated)..........tons..	484, 004, 000	72, 068, 000
Capacity of mines with present labor force (assuming 308 working days)..........tons..	871, 000, 000	([a])
Average number of days worked..........	171	274
Average days idle:		
All causes..........	137	30
Through strikes and lockouts..........	7	7
Other causes..........	130	23
Average number employed..........	619, 604	160, 009
Miners, loaders, and shot firers....	380, 324	76, 035
Other underground.	151, 580	43, 328
Surface..........	87, 700	40, 646
Output per man per day..........tons..	4. 56	[c] 2. 0
Number of cutting machines..........	18, 660	([a])
Quantity cut by machines..........tons..	336, 271, 335	1, 271, 325
Per cent of output cut by machines..........	69. 5	1. 6
Number of power shovels in strip pits..........	420	95
Quantity produced by stripping..........tons..	13, 606, 954	1, 665, 783

[a] Data not available.

[b] Producers' stocks.

[c] Net tons.

TABLE 2.—*Summary of coal produced, value, men employed, days worked, and output per man per day, by States, 1923 and 1924*

State	Net tons					Value		Number of employees				Average number of days worked	Average tons per man per day
								Underground					
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners,[a] loaders, etc.	All others	Surface	Total		
1923													
Alabama	19,520,634	370,754	307,356	258,905	20,457,649	$51,624,000	$2.52	17,304	7,330	5,401	30,035	232	2.93
Alaska	104,867	12,734	2,225	----------	119,826	755,000	6.30	73	48	78	199	220	2.74
Arkansas	1,245,350	12,845	38,697	----------	1,296,892	5,192,000	4.01	2,124	846	784	3,754	97	3.39
California, Idaho, and Oregon	11,256	1,555	7,255	----------	20,066	79,000	3.94	43	26	24	93	206	1.05
Colorado	9,390,124	534,464	231,595	190,035	10,346,218	33,299,000	3.22	8,064	3,114	2,162	13,340	174	4.45
Georgia	48,172	733	2,554	24,161	75,620	327,000	4.32	69	23	75	167	231	1.96
Illinois	73,842,388	3,606,769	1,860,918	----------	79,310,075	198,388,000	2.50	64,194	24,900	10,620	99,714	158	5.02
Indiana	24,951,649	697,832	579,618	----------	26,229,099	65,046,000	2.48	22,777	8,228	4,403	35,408	136	5.43
Iowa	5,027,502	556,180	127,053	----------	5,710,735	20,517,000	3.59	7,797	2,709	942	11,448	181	2.75
Kansas	4,092,792	268,082	82,275	----------	4,443,149	14,275,000	3.21	6,966	1,662	1,133	9,761	139	3.19
Kentucky	43,149,962	844,094	552,943	230,318	44,777,317	113,542,000	2.54	33,911	16,546	10,354	60,811	152	4.83
Maryland	2,181,688	77,823	26,415	----------	2,285,926	6,911,000	3.02	2,360	814	551	3,725	178	3.42
Michigan	1,086,198	16,235	69,642	----------	1,172,075	5,545,000	4.73	1,213	580	184	1,977	222	2.67
Missouri	3,101,275	211,447	90,429	----------	3,403,151	11,575,000	3.40	4,217	1,335	1,400	6,952	155	3.07
Montana	2,934,829	118,060	94,789	----------	3,147,678	9,652,000	3.07	2,054	910	547	3,511	179	5.00
New Mexico	2,572,465	38,684	46,689	257,335	2,915,173	10,668,000	3.66	2,522	1,025	548	4,095	216	3.28
North Carolina	29,419	1,700	4,900	----------	36,019	132,000	3.66	55	70	25	150	275	.87
North Dakota	1,128,318	218,574	38,508	----------	1,385,400	3,275,000	2.36	883	257	481	1,621	182	4.60
Ohio	37,273,886	2,672,268	600,289	----------	40,546,443	98,610,000	2.43	34,121	12,225	8,209	54,555	150	4.95
Oklahoma	2,722,387	37,998	117,022	7,631	2,885,038	10,874,000	3.77	4,100	1,930	1,100	7,130	133	2.99
Pennsylvania (bituminous)	138,275,133	7,359,213	2,507,227	23,738,340	171,879,913	472,217,000	2.75	120,385	46,183	28,413	194,981	213	4.15
South Dakota	2,000	8,379	----------	----------	10,379	25,000	2.41	34	----------	----------	34	122	2.50
Tennessee	5,614,117	119,657	115,783	190,711	6,040,268	16,515,000	2.73	6,752	2,733	1,759	11,244	183	2.93
Texas	1,156,901	6,564	23,864	----------	1,187,329	2,162,000	1.82	1,641	493	318	2,452	178	2.72
Utah	4,179,293	56,471	81,399	403,054	4,720,217	13,657,000	2.89	2,379	1,063	939	4,381	160	6.73
Virginia	10,292,691	212,131	96,041	1,160,780	11,761,643	32,468,000	2.76	6,810	4,841	2,469	14,120	212	3.92
Washington	2,697,984	80,881	87,973	59,554	2,926,392	10,894,000	3.72	2,313	1,147	846	4,306	213	3.19
West Virginia	101,961,199	3,841,346	758,904	1,338,492	107,899,941	285,481,000	2.65	62,676	35,207	19,417	117,300	169	5.44
Wyoming	7,264,816	97,567	212,648	----------	7,575,031	20,916,000	2.76	4,203	2,020	1,306	7,529	192	5.23
Total bituminous, including wagon mines	505,859,295	22,081,040	8,765,011	27,859,316	564,564,662	1,514,621,000	2.68	422,040	178,265	104,488	704,793	179	4.47
Pennsylvania anthracite	82,239,037	3,248,352	7,851,620	----------	93,339,009	506,787,000	5.43	72,362	42,359	43,022	157,743	268	2.21
Grand total	588,098,332	25,329,392	16,616,631	27,859,316	657,903,671	2,021,408,000	3.07	494,402	220,624	147,510	862,536	195	3.91

1924 [c] [d]													
Alabama	18,395,094	348,580	215,450	171,060	19,130,184	44,756,000	2.34	15,892	7,216	4,848	27,956	220	3.11
Alaska	93,932	4,321	1,410		99,663	560,000	5.62	60	40	67	167	287	2.08
Arkansas	1,402,929	15,019	33,555		1,451,503	5,898,000	4.06	1,811	732	807	3,350	134	3.24
California, Idaho, Nebraska, and Oregon	8,352	7,851	750		16,953	71,000	4.19	36	20	27	83	156	1.31
Colorado	9,512,534	561,539	236,696	133,329	10,444,098	31,863,000	3.05	8,023	2,978	1,953	12,954	178	[b]4.52
Georgia	58,097	611	1,839	14,400	74,947	271,000	3.62	55	19	69	143	248	2.11
Illinois	63,689,920	3,319,700	1,313,661		68,323,281	155,260,000	2.27	59,451	21,306	8,606	89,363	148	5.16
Indiana	20,338,416	725,561	416,236		21,480,213	46,453,000	2.16	17,717	6,210	3,631	27,558	136	5.75
Iowa	4,351,252	993,393	123,805		5,468,450	18,097,000	3.31	8,382	2,677	1,042	12,101	161	2.80
Kansas	3,871,125	309,806	66,802		4,247,733	12,854,000	3.03	6,182	1,250	1,129	8,561	151	3.29
Kentucky	43,683,182	859,023	458,205	146,794	45,147,204	84,733,000	1.88	31,864	14,703	9,199	55,766	174	4.67
Maryland	1,945,259	171,925	16,519		2,133,703	4,629,000	2.17	2,373	856	547	3,776	173	3.27
Michigan	767,359	6,433	57,228		831,020	3,602,000	4.33	1,016	390	145	1,551	178	3.00
Missouri	2,169,155	244,302	67,423		2,480,880	8,154,000	3.29	3,649	1,068	1,260	5,977	135	3.08
Montana	2,650,836	170,590	83,939		2,905,365	8,596,000	2.96	1,852	823	521	3,196	173	5.26
New Mexico	2,549,438	49,001	51,412	136,212	2,786,063	9,774,000	3.51	2,416	851	939	4,206	204	3.25
North Carolina	51,094	1,200	4,800		57,094	224,000	3.92	60	33	27	120	287	1.66
North Dakota	957,987	212,994	29,546		1,200,527	2,473,000	2.06	671	186	441	1,298	165	5.62
Ohio	27,404,951	2,685,565	382,491		30,473,007	62,011,000	2.03	29,481	8,966	5,782	44,229	143	4.82
Oklahoma	2,236,937	35,999	56,679		2,329,615	8,590,000	3.69	3,324	1,740	1,080	6,144	124	3.05
Pennsylvania (bituminous)	110,240,821	6,565,736	1,835,366	11,991,850	130,633,773	295,164,000	2.26	108,773	38,312	22,237	169,322	180	4.27
South Dakota	3,000	9,043			12,043	36,000	2.99	40			40	138	2.18
Tennessee	4,142,873	73,700	109,781	230,201	4,556,555	9,711,000	2.13	5,726	2,236	1,403	9,365	159	3.05
Texas	1,119,048	7,256	20,707		1,147,011	1,721,000	1.50	1,426	456	313	2,195	166	3.16
Utah	4,107,261	51,400	60,566	268,930	4,488,157	12,057,000	2.69	2,369	1,023	938	4,330	182	[b]5.70
Virginia	9,756,162	168,530	51,951	716,821	10,693,464	21,823,000	2.04	6,131	4,255	2,293	12,679	226	3.73
Washington	2,442,059	92,366	69,903	49,339	2,653,667	9,689,000	3.65	2,192	982	684	3,858	202	3.41
West Virginia	97,169,314	3,307,505	652,855	533,223	101,662,897	185,229,000	1.82	55,067	30,480	16,656	102,203	182	5.48
Wyoming	6,447,307	112,055	198,106		6,757,468	18,327,000	2.71	4,285	1,772	1,056	7,113	176	5.41
Total bituminous, excluding wagon mines	441,565,694	21,111,004	6,617,681	14,392,159	483,686,538	1,062,626,000	2.20	380,324	151,580	87,700	619,604	171	4.56
Pennsylvania anthracite	77,247,499	3,043,939	7,635,424		87,926,862	477,231,000	5.43	76,035	43,328	40,646	160,009	274	2.00
Grand total	518,813,193	24,154,943	14,253,105	14,392,159	571,613,400	1,539,857,000	2.69	456,359	194,908	128,346	779,613	192	3.81

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[a] Also includes shot firers.

[b] See Table 31, note [a].

[c] Note that figures of men employed and days worked for 1924 do not include mines that operated in 1923, but were idle the entire year 1924; they do include many mines operating for a short time only in 1924. The number of active bituminous coal mines of commercial size in the United States was 9,331 in 1923, and 7,586 in 1924.

[d] Exclusive of product of wagon mines; no canvass made.

TABLE 3.—*Production, imports, exports, and consumption of anthracite and bituminous coal, 1913–1924, in net tons*

Calendar year	Production	Imports	Exports to—		Net changes in stocks [a]	Consumption in the United States [b]
			Canada and Mexico	Other countries (sea borne)		
Anthracite:						
1913	91,525,000	[c] 2,000	4,573,000	80,000	+1,400,000	85,474,000
1914	90,822,000	[c] 9,000	4,220,000	70,000	+2,500,000	84,041,000
1915	88,995,000	[c] 14,000	3,854,000	111,000	−3,100,000	88,144,000
1916	87,578,000	6,000	4,558,000	108,000	−4,200,000	87,118,000
1917	99,612,000	13,000	5,917,000	90,000	−450,000	94,068,000
1918	98,826,000	37,000	4,910,000	58,000	+1,120,000	92,775,000
1919	88,092,000	83,000	4,871,000	106,000	+1,680,000	81,518,000
1920	89,598,000	32,000	4,987,000	417,000	−1,560,000	85,786,000
1921	90,473,000	9,000	4,569,000	108,000	+3,855,000	81,950,000
1922	54,683,000	234,000	2,579,000	70,000	−4,530,000	56,798,000
1923	93,339,000	300,000	4,993,000	97,000	+1,635,000	86,914,000
1924	87,927,000	118,000	3,932,000	86,000	+3,310,000	80,717,000
Bituminous:						
1913	478,436,000	1,583,000	15,650,000	4,495,000	([d])	459,874,000
1914	422,704,000	1,546,000	10,674,000	4,784,000	([d])	408,792,000
1915	442,624,000	1,709,000	9,670,000	9,107,000	([d])	425,556,000
1916	502,520,000	1,714,000	13,481,000	7,774,000	−11,000,000	493,979,000
1917	551,791,000	1,448,000	18,324,000	5,506,000		529,409,000
1918	579,386,000	1,457,000	18,316,000	4,034,000	+27,900,000	530,593,000
1919	465,860,000	1,012,000	12,064,000	8,050,000	−34,900,000	481,658,000
1920	568,667,000	1,245,000	16,458,000	22,059,000	+22,800,000	508,595,000
1921	415,922,000	1,258,000	13,590,000	9,541,000	+2,200,000	391,849,000
1922	422,268,000	5,060,000	10,938,000	1,475,000	−12,000,000	426,915,000
1923	564,565,000	1,882,000	16,960,000	4,494,000	+26,000,000	518,993,000
1924	483,687,000	417,000	12,746,000	4,354,000	−17,000,000	484,004,000

[a] Anthracite figures are producers' stocks; bituminous, consumers' stocks. Plus sign denotes coal produced but added to stocks and not consumed; minus sign denotes coal consumed that was withdrawn from stocks carried over from preceding year. Anthracite data from Federal Trade Commission cost reports (Coal, No. 2, p. 27) and hearings before Frelinghuysen coal committee, S. Res. 126, 66th Congress, 1st session (part 1, p. 308). These anthracite figures through 1918 represent coal years, since then calendar years, and are in part estimates. Bituminous data from reports on consumers' stocks of bituminous coal issued by U. S. Geological Survey and article in Coal Age, Aug. 26, 1920, p. 429, by C. E. Lesher, formerly coal statistician, U. S. Geological Survey, and director of statistical division, U. S. Fuel Administration.

[b] Production tonnage, plus imports and minus exports, plus or minus the decrease or increase, respectively, of the net change in coal stocks.

[c] Fiscal year ended June 30.

[d] No data available.

TABLE 4.—*Net changes in consumers' stocks of bituminous coal as indicated by the periodic surveys of stocks, January 1, 1922, to December 31, 1924*

Period	Net change in stocks (net tons)	Average rate of change per month (net tons)
1922		
Jan. 1 to Mar. 1	+4,500,000	+2,250,000
Mar. 1 to Apr. 1	+10,500,000	+10,500,000
Apr. 1 to Sept. 1	−41,000,000	−8,200,000
Sept. 1 to Oct. 1	+4,000,000	+4,000,000
Oct. 1 to Nov. 1	+6,000,000	+6,000,000
Nov. 1 to Dec. 31	+4,000,000	+2,000,000
1923		
Jan. 1 to Feb. 1	+2,000,000	+2,000,000
Feb. 1 to Mar. 1	−2,000,000	−2,000,000
Mar. 1 to June 1	+6,000,000	+2,000,000
June 1 to July 1	+4,000,000	+4,000,000
July 1 to Aug. 1	+6,000,000	+6,000,000
Aug. 1 to Sept. 1	+4,000,000	+4,000,000
Sept. 1 to Oct. 1	+4,000,000	+4,000,000
Oct. 1 to Dec. 31	+2,000,000	+667,000
1924		
Jan. 1 to June 1	−11,000,000	−2,200,000
June 1 to Sept. 1	−4,000,000	−1,333,000
Sept. 1 to Dec. 31 [a]	−2,000,000	−500,000

[a] Stocks on Dec. 31 estimated from those reported on Sept. 1 and on Mar. 1, 1925, at 45,000,000.

GENERAL STATISTICS

GROWTH OF THE INDUSTRY

Table 5.—*Growth of the bituminous coal-mining industry, 1890–1924*

Year	Production (millions of net tons)	Value (millions of dollars)	Men employed (thousands)	Average number of days worked	Average number days lost on account of—			Value per ton	Net tons per man per day	Per cent mined by machine
					Strikes	Other causes	Total lost			
1890	111	110	192	226	(a)	(a)	82	$0.99	2.56	(a)
1891	118	117	206	223	(a)	(a)	85	.99	2.57	5.3
1892	127	125	213	219	(a)	(a)	89	.99	2.72	(a)
1893	128	123	230	204	(a)	(a)	104	.96	2.73	(a)
1894	119	108	245	171	(a)	(a)	137	.91	2.84	(a)
1895	135	116	240	194	(a)	(a)	114	.86	2.90	(a)
1896	138	115	244	192	(a)	(a)	116	.83	2.94	11.9
1897	148	120	248	196	(a)	(a)	112	.81	3.04	15.3
1898	167	133	256	211	(a)	(a)	97	.80	3.09	19.5
1899	193	168	271	234	8	66	74	.87	3.05	22.7
1900	212	221	304	234	5	69	74	1.04	2.98	24.9
1901	226	236	340	225	2	81	83	1.05	2.94	25.6
1902	260	291	370	230	7	71	78	1.12	3.06	26.8
1903	283	352	416	225	3	80	83	1.24	3.02	27.6
1904	279	306	438	202	8	98	106	1.10	3.15	28.2
1905	315	335	461	211	2	95	97	1.06	3.24	32.8
1906	343	381	478	213	28	67	95	1.11	3.36	34.7
1907	395	451	513	234	1	73	74	1.14	3.29	35.1
1908	333	374	516	193	11	104	115	1.12	3.34	37.0
1909	380	405	543	209	1	98	99	1.07	(a)	37.5
1910	417	469	556	217	35	56	91	1.12	3.46	41.7
1911	406	451	550	211	2	95	97	1.11	3.50	43.9
1912	450	518	549	223	10	75	85	1.15	3.68	46.8
1913	478	565	572	232	5	71	76	1.18	3.61	50.7
1914	423	493	584	195	19	94	113	1.17	3.71	51.7
1915	443	502	557	203	4	101	105	1.13	3.91	55.0
1916	503	665	561	230	4	74	78	1.32	3.90	56.5
1917	552	1,249	603	243	4	61	65	2.26	3.77	55.5
1918	579	1,492	615	249	1	58	59	2.58	3.78	55.9
1919	466	1,161	622	195	25	88	113	2.49	3.84	59.2
1920	569	2,130	640	220	6	82	88	3.75	4.00	59.8
1921	416	1,200	664	149	3	156	159	2.89	4.20	65.6
1922	422	1,275	688	142	78	88	166	3.02	4.28	63.2
1923	565	1,515	705	179	2	127	129	2.68	4.48	66.9
1924	484	1,063	620	171	7	130	137	2.20	4.56	69.5

[a] No data.

TABLE 6.—*Growth of the anthracite mining industry, 1890–1924*

Year	Production (millions of gross tons)	Value (millions of dollars)	Employees (thousands)	Average number of days worked	Average days lost on account of strikes	Net tons per man per day	Washery and dredge shipments (millions of gross tons)	Per cent of shipments that were domestic sizes (excluding pea)
1890	41	66	126	200	(a)	1.85	(b)	76.9
1891	45	74	126	203	(a)	1.98	0.1	75.7
1892	47	82	129	198	(a)	2.06	.1	76.0
1893	48	86	133	197	(a)	2.06	.2	74.9
1894	46	78	132	190	(a)	2.08	.6	73.7
1895	52	82	143	196	(a)	2.07	1.1	69.9
1896	49	82	149	174	(a)	2.10	.9	70.3
1897	47	79	150	150	(a)	2.34	1.0	68.5
1898	48	75	146	152	(a)	2.41	1.1	67.3
1899	54	88	140	173	(a)	2.50	1.4	66.1
1900	51	86	144	166	24	2.40	2.1	64.7
1901	60	113	145	196	----------	2.37	2.6	64.2
1902	37	76	148	116	96	2.40	2.0	61.0
1903	67	152	150	206	----------	2.41	3.6	63.6
1904	65	139	156	200	−½	2.35	2.8	62.0
1905	69	142	165	215	−½	2.18	2.6	60.9
1906	64	132	162	195	37	2.25	3.8	59.1
1907	76	164	167	220	----------	2.33	4.3	58.6
1908	74	158	174	200	----------	2.39	3.6	59.3
1909	72	149	(a)	205	−½	(a)	3.7	58.3
1910	75	161	169	229	−½	2.17	3.3	58.6
1911	81	175	173	246	−½	2.13	3.2	59.4
1912	75	178	174	231	40	2.10	3.2	60.8
1913	82	195	176	257	3	2.02	2.1	61.7
1914	81	188	180	245	1	2.06	1.7	61.4
1915	79	185	177	230	1	2.19	2.5	60.1
1916	78	202	160	253	6	2.16	3.1	60.5
1917	[c]89	284	154	285	1	[c]2.27	5.4	61.0
1918	[c]88	336	147	293	−½	[c]2.29	6.6	60.1
1919	79	365	155	266	2	2.14	3.3	64.2
1920	[c]80	434	145	271	13	[c]2.28	5.0	63.1
1921	81	452	160	271	5	2.09	1.6	66.5
1922	[c]49	274	157	151	125	[c]2.31	3.2	62.9
1923	83	507	158	268	17	2.21	4.1	63.7
1924	79	477	160	274	7	2.00	1.4	65.0

[a] No data. [b] Less than one-tenth million tons. [c] Years of heavy washery output.

TABLE 7.—*Shift in disposal of total output of bituminous coal, 1890–1924*

Year	Percentage of total—			
	Loaded at mines for shipment	Made into coke at mines	Sold to local trade	Used at mines for steam and heat
1890	78.5	13.8	6.3	1.4
1895	78.7	13.6	6.2	1.5
1900	81.5	13.0	3.7	1.8
1905	80.9	13.5	3.4	2.2
1910	82.2	12.5	3.0	2.3
1915	85.8	9.2	2.8	2.2
1916	84.3	10.4	3.2	2.1
1917	85.2	9.1	3.5	2.2
1918	86.8	7.8	3.2	2.2
1919	87.8	5.9	3.9	2.4
1920	88.8	5.4	3.7	2.1
1921	91.8	2.1	3.9	2.2
1922	90.9	3.1	4.1	1.9
1923	89.6	4.9	3.9	1.6
1924	91.3	3.0	4.3	1.4

COMPETITION OF COAL AND OTHER SOURCES OF POWER

TABLE 8.—*Annual supply of energy from mineral fuels and water power in the United States, 1819–1924*

[Figures represent trillions of British thermal units and because of rounding do not always add across exactly. Water power is represented by British thermal units of coal necessary to produce the same amount of power. Figures represent production except those for oil imports, and take no account of changes of stock]

Year	Anthracite	Bituminous coal	Total coal	Domestic oil	Natural gas	Imported oil	Total oil and gas	Total mineral fuels	Water power[a]	Grand total, including water power
1819	(b)	--------	(b)	--------	--------	--------	--------	(b)	(a)	(a)
1829	4	3	6	--------	--------	--------	--------	6	(a)	(a)
1839	27	41	68	--------	--------	--------	--------	68	(a)	(a)
1849	109	64	173	--------	--------	--------	--------	173	(a)	(a)
1859	262	158	419	(b)	--------	--------	--------	419	(a)	(a)
1869	464	415	879	25	--------	--------	25	904	(a)	(a)
1879	822	993	1,815	119	(b)	--------	119	1,934	(a)	(a)
1889	1,239	2,507	3,746	211	[c] 268	--------	479	4,225	91	4,316
1899	1,643	5,065	6,708	342	[c] 240	--------	582	7,291	135	7,426
1909	2,205	9,949	12,155	1,099	517	(d)	1,616	13,771	411	14,182
1913	2,490	12,535	15,025	1,491	626	102	2,219	17,243	588	17,831
1918	2,688	15,180	17,868	2,136	775	226	3,137	21,005	837	21,842
1919	2,396	12,206	14,602	2,270	802	317	3,389	17,991	892	18,883
1920	2,437	14,899	17,336	2,658	858	637	4,153	21,489	971	22,460
1921	2,461	10,897	13,358	2,833	712	752	4,297	17,655	908	18,563
1922	1,487	11,063	12,551	3,345	820	764	4,929	17,480	1,024	18,504
1923	2,539	14,791	17,330	4,394	[e] 1,082	492	[e] 5,968	[e] 23,298	1,136	[e] 24,434
1924	2,392	12,672	15,064	4,284	1,227	467	5,978	21,042	1,167	22,209

[a] No figures for water power are available before 1889. The fuel equivalent for water power is calculated from the reported horsepower of installed water wheels, assuming a capacity factor of 20 per cent for manufactures and mines and of 40 per cent for public utilities, and assuming that the theoretical thermal equivalent of 1 horsepower-hour (2,547 British thermal units) is 7 per cent of the British thermal units that would have been consumed in generating 1 horsepower-hour from fuels in practice. For 1919 to 1924, however, actual reports of the horsepower-hours produced by water in electric utility plants, as recorded by the U. S. Geological Survey, have been used.

[b] Less than 0.5.

[c] Based on the amount of coal displaced by gas, as estimated by the gas companies at the time.

[d] Imports negligible before 1913.

[e] Revised figures.

TABLE 9.—*Relative rates of growth of coal, oil, and water power in the United States, 1819–1924*

[The figures for 1918 are represented by the number 100, and the figures for all other years are expressed as a percentage of the 1918 rate]

Year	Anthracite	Bituminous coal	Total coal	Domestic oil	Natural gas	Imported oil	Total oil and gas	Total mineral fuels	Water power	Grand total, including water power
1819	(a)	--------	(a)	--------	--------	--------	--------	(a)	(b)	(b)
1829	(a)	(a)	(a)	--------	--------	--------	--------	(a)	(b)	(b)
1839	1	(a)	(a)	--------	--------	--------	--------	(a)	(b)	(b)
1849	4	(a)	1	--------	--------	--------	--------	1	(b)	(b)
1859	10	1	2	(a)	--------	--------	(a)	2	(b)	(b)
1869	17	3	5	1	--------	--------	1	4	(b)	(b)
1879	31	6	10	6	(a)	--------	4	9	(b)	(b)
1889	46	17	21	10	35	--------	15	20	11	20
1899	61	33	37	16	31	--------	19	35	16	34
1909	82	66	68	51	67	(c)	52	66	49	65
1913	93	83	84	70	81	45	71	82	70	82
1918	100	100	100	100	100	100	100	100	100	100
1919	89	80	81	106	103	140	108	86	107	86
1920	91	98	97	124	111	282	132	102	116	103
1921	92	72	74	132	92	333	137	84	109	85
1922	55	73	70	156	106	338	157	83	122	85
1923	94	97	97	206	140	218	191	111	136	112
1924	89	83	84	201	158	207	191	100	139	102

[a] Less than 0.5. [b] No data for water power prior to 1889. [c] Imports negligible prior to 1913.

TABLE 10.—*Per cent of total heating value contributed by the several mineral fuels in the United States, 1819–1924*

Year	Anthracite	Bituminous coal	Total coal	Domestic oil	Natural gas	Imported oil	Total oil and gas	Grand total fuels	Water power per cent of fuels [a]
1819	100.0	----------	100.0	----------	----------	----------	----------	100.0	([a])
1829	58.4	41.6	100.0	----------	----------	----------	----------	100.0	([a])
1839	40.2	59.8	100.0	----------	----------	----------	----------	100.0	([a])
1849	62.8	37.2	100.0	----------	----------	----------	----------	100.0	([a])
1859	62.3	37.7	100.0	([b])	----------	----------	----------	100.0	([a])
1869	51.3	45.9	97.2	2.8	([b])	----------	2.8	100.0	([a])
1879	42.5	51.3	93.8	6.2	([b])	----------	6.2	100.0	([a])
1889	29.3	59.3	88.6	5.0	[c] 6.4	----------	11.4	100.0	2.2
1899	22.5	69.5	92.0	4.7	[c] 3.3	----------	8.0	100.0	1.9
1909	16.0	72.2	88.2	8.0	3.8	([b])	11.8	100.0	3.0
1913	14.4	72.7	87.1	8.7	3.6	0.6	12.9	100.0	3.4
1918	12.8	72.3	85.1	10.1	3.7	1.1	14.9	100.0	4.0
1919	13.3	67.9	81.2	12.6	4.5	1.7	18.8	100.0	5.0
1920	11.4	69.3	80.7	12.4	4.0	2.9	19.3	100.0	5.0
1921	14.0	61.7	75.7	16.0	4.0	4.3	24.3	100.0	5.1
1922	8.5	63.3	71.8	19.1	4.7	4.4	28.2	100.0	5.9
1923	10.9	63.5	74.4	18.9	4.6	2.1	25.6	100.0	4.9
1924	11.4	60.2	71.6	20.4	5.8	2.2	28.4	100.0	5.5

[a] No figures for water power are available before 1889; hence to make the figures comparable, the data for water power thereafter are expressed as per cent of the fuel total but are not included in the base on which the percentages are computed.

[b] Less than 0.1 per cent.

[c] Figures from 1869 to 1899 based on estimated quantity of coal displaced.

TABLE 11.—*Indicated domestic consumption in the United States of crude petroleum, gas and fuel oils, and natural gas for fuel, contrasted with the equivalent quantity of coal, 1919–1924* [a]

	Units	1919	1920	1921	1922	1923	1924
Indicated domestic consumption of crude petroleum.[b]	Million barrels	423	522	521	585	715	748
Crude oil run to refinery stills	do	362	434	443	501	581	644
Indicated consumption of crude petroleum for fuel (including losses).	do	61	88	78	84	134	104
Indicated consumption of gas and fuel oils.	do	164	186	196	240	261	293
Consumption of crude petroleum and gas and fuel oils for fuel.	do	225	274	274	324	395	397
Energy equivalent of No. 5	Trillion B. t. u	1,383	1,681	1,683	1,992	2,422	2,431
Approximate equivalent in coal of No. 5.	Million net tons	53	64	64	76	92	93
Energy equivalent of natural gas consumed for fuel (gas used in making carbon black not included).	Trillion B. t. u	748	804	657	762	957	1,059
Approximate equivalent in coal of natural gas in No. 8.	Million net tons	29	31	25	29	37	40
Percentage of the annual production of coal in the United States for Nos. 6 and 8.	Per cent	15	14	18	22	20	23

[a] Prepared by G. B. Richardson, U. S. Geological Survey.

[b] Production plus imports minus exports plus stocks, including refinery stocks, at beginning of year, minus stocks at end of year.

PRODUCTION SUMMARIES, BY STATES AND FIELDS

TABLE 12.—*Coal produced, by States, in 1923–24, and increase or decrease in 1924*

State	1923		1924 [a]					
	Net tons	Value	Net tons	Value	Increase or decrease			
					Quantity		Value	
					Net tons	Percentage	Dollars	Percentage
Alabama	20, 457, 649	$51, 624, 000	19, 130, 184	$44, 756, 000	−1, 327, 465	−6. 5	−6, 868, 000	−13. 3
Arkansas	1, 296, 892	5, 192, 000	1, 451, 503	5, 898, 000	+154, 611	+11. 9	+706, 000	+13. 6
California, Alaska, Idaho, Nebraska, [b] and Oregon	139, 892	834, 000	116, 616	631, 000	−23, 276	−16. 6	−203, 000	−24. 3
Colorado	10, 346, 218	33, 299, 000	10, 444, 098	31, 863, 000	+97, 880	+. 9	−1, 436, 000	−4. 3
Georgia	75, 620	327, 000	74, 947	271, 000	−673	−. 9	−56, 000	−17. 1
Illinois	79, 310, 075	198, 388, 000	68, 323, 281	155, 260, 000	−10, 986, 794	−13. 9	−43, 128, 000	−21. 7
Indiana	26, 229, 099	65, 046, 000	21, 480, 213	46, 453, 000	−4, 748, 886	−18. 1	−18, 593, 000	−28. 6
Iowa	5, 710, 735	20, 517, 000	5, 468, 450	18, 097, 000	−242, 285	−4. 2	−2, 420, 000	−11. 8
Kansas	4, 443, 149	14, 275, 000	4, 247, 733	12, 854, 000	−195, 416	−4. 4	−1, 421, 000	−10. 0
Kentucky	44, 777, 317	113, 542, 000	45, 147, 204	84, 733, 000	+369, 887	+. 8	−28, 809, 000	−25. 4
Maryland	2, 285, 926	6, 911, 000	2, 133, 703	4, 629, 000	−152, 223	−6. 6	−2, 282, 000	−33. 0
Michigan	1, 172, 075	5, 545, 000	831, 020	3, 602, 000	−341, 055	−29. 1	−1, 943, 000	−35. 0
Missouri	3, 403, 151	11, 575, 000	2, 480, 880	8, 154, 000	−922, 271	−27. 1	−3, 421, 000	−29. 6
Montana	3, 147, 678	9, 652, 000	2, 905, 365	8, 596, 000	−242, 313	−7. 7	−1, 056, 000	−10. 9
New Mexico	2, 915, 173	10, 668, 000	2, 786, 063	9, 774, 000	−129, 110	−4. 4	−894, 000	−8. 4
North Carolina	36, 019	132, 000	57, 094	224, 000	+21, 075	+58. 5	+92, 000	+69. 7
North Dakota	1, 385, 400	3, 275, 000	1, 200, 527	2, 473, 000	−184, 873	−13. 3	−802, 000	−24. 5
Ohio	40, 546, 443	98, 610, 000	30, 473, 007	62, 011, 000	−10, 073, 436	−24. 8	−36, 599, 000	−37. 1
Oklahoma	2, 885, 038	10, 874, 000	2, 329, 615	8, 590, 000	−555, 423	−19. 3	−2, 284, 000	−21. 0
Pennsylvania (bituminous)	171, 879, 913	472, 217, 000	130, 633, 773	295, 164, 000	−41, 246, 140	−24. 0	−177, 053, 000	−37. 5
South Dakota	10, 379	25, 000	12, 043	36, 000	+1, 664	+16. 0	+11, 000	+44. 0
Tennessee	6, 040, 268	16, 515, 000	4, 556, 555	9, 711, 000	−1, 483, 713	−24. 6	−6, 804, 000	−41. 2
Texas	1, 187, 329	2, 162, 000	1, 147, 011	1, 721, 000	−40, 318	−3. 4	−441, 000	−20. 4
Utah	4, 720, 217	13, 657, 000	4, 488, 157	12, 057, 000	−232, 060	−4. 9	−1, 600, 000	−11. 7
Virginia	11, 761, 643	32, 468, 000	10, 693, 464	21, 823, 000	−1, 068, 179	−9. 1	−10, 645, 000	−32. 8
Washington	2, 926, 392	10, 894, 000	2, 653, 667	9, 689, 000	−272, 725	−9. 3	−1, 205, 000	−11. 1
West Virginia	107, 899, 941	285, 481, 000	101, 662, 897	185, 229, 000	−6, 237, 044	−5. 8	−100, 252, 000	−35. 1
Wyoming	7, 575, 031	20, 916, 000	6, 757, 468	18, 327, 000	−817, 563	−10. 8	−2, 589, 000	−12. 4
Total bituminous	564, 564, 662	1, 514, 621, 000	483, 686, 538	1, 062, 626, 000	−80, 878, 124	−14. 3	−451, 995, 000	−29. 8
Pennsylvania anthracite	93, 339, 009	506, 787, 000	87, 926, 862	477, 231, 000	−5, 412, 147	−5. 8	−29, 556, 000	−5. 8
Grand total	657, 903, 671	2, 021, 408, 000	571, 613, 400	1, 539, 857, 000	−86, 290, 271	−13. 1	−481, 551, 000	−23. 8

[a] Exclusive of wagon mines; no canvass made.

[b] No production from Nebraska in 1923.

TABLE 13.—*Comparison of bituminous coal produced, by States, in 1913, 1920, 1923, and 1924*

State	Production (net tons)				Per cent of increase or decrease		
	1913	1920	1923	1924	1923 to 1924	1920 to 1924	1913 to 1924
Alabama	17, 678, 522	[a] 19,184, 962	20, 457, 649	19, 130, 184	−6. 5	[a] −0. 3	+8. 2
Arkansas	2, 234, 107	2, 103, 596	1, 296, 892	1, 451, 503	+11. 9	−31. 0	−35. 0
Colorado	9, 232, 510	12, 278, 225	10, 346, 218	10, 444, 098	+. 9	−14. 9	+13. 1
Georgia	255, 626	50, 156	75, 620	74, 947	−. 9	+49. 4	−70. 7
Illinois	61, 618, 744	88, 724, 893	79, 310, 075	68, 323, 281	−13. 9	−23. 0	+10. 9
Indiana	17, 165, 671	29, 350, 585	26, 229, 099	21, 480, 213	−18. 1	−26. 8	+25. 1
Iowa	7, 525, 936	7, 813, 916	5, 710, 735	5, 468, 450	−4. 2	−30. 0	−27. 3
Kansas	7, 202, 210	5, 926, 408	4, 443, 149	4, 247, 733	−4. 4	−28. 3	−41. 0
Kentucky	19, 616, 600	35, 690, 762	44, 777, 317	45, 147, 204	+. 8	+26. 5	+130. 1
Maryland	4, 779, 839	4, 065, 239	2, 285, 926	2, 133, 703	−6. 6	−47. 5	−55. 4
Michigan	1, 231, 786	1, 489, 765	1, 172, 075	831, 020	−29. 1	−44. 2	−32. 5
Missouri	4, 318, 125	5, 369, 565	3, 403, 151	2, 480, 880	−27. 1	−53. 8	−42. 5
Montana	3, 240, 973	4, 413, 866	3, 147, 678	2, 905, 365	−7. 7	−34. 2	−10. 4
New Mexico	3, 708, 806	3, 683, 440	2, 915, 173	2, 786, 063	−4. 4	−24. 4	−24. 9
North Dakota	495, 320	948, 625	1, 385, 400	1, 200, 527	−13. 3	+26. 6	+142. 4
Ohio	36, 200, 527	45, 878, 191	40, 546, 443	30, 473, 007	−24. 8	−33. 6	−15. 8
Oklahoma	4, 165, 770	4, 849, 288	2, 885, 038	2, 329, 615	−19. 3	−51. 9	−44. 1
Pennsylvania	173, 781, 217	170, 607, 847	171, 879, 913	130, 633, 773	−24. 0	−18. 2	−24. 8
South Dakota	10, 540	12, 777	10, 379	12, 043	+16. 0	−5. 7	+14. 3
Tennessee	6, 860, 184	6, 662, 428	6, 040, 268	4, 556, 555	−24. 6	−31. 6	−33. 6
Texas	2, 429, 144	1, 615, 015	1, 187, 329	1, 147, 011	−3. 4	−29. 0	−52. 8
Utah	3, 254, 828	6, 005, 199	4, 720, 217	4, 488, 157	−4. 9	−25. 3	+37. 9
Virginia	8, 828, 068	11, 378, 606	11, 761, 643	10, 693, 464	−9. 1	−6. 0	+21. 1
Washington	3, 877, 891	3, 757, 093	2, 926, 392	2, 653, 667	−9. 3	−29. 4	−31. 6
West Virginia	71, 254, 136	89, 970, 707	107, 899, 941	101, 662, 897	−5. 8	+13. 0	+42. 7
Wyoming	7, 393, 066	9, 630, 271	7, 575, 031	6, 757, 468	−10. 8	−29. 8	−8. 6
Other States	75, 151	96, 121	175, 911	173, 710	−1. 3	+80. 7	+131. 1
	478, 435, 297	[b] 568,666,683	564, 564, 662	483, 686, 538	−14. 3	−14. 9	+1. 1

[a] Because Alabama was affected by a strike in 1920, the production of 1918 is used for comparison.
[b] Total for 1920. This column does not add because of the substitution of the 1918 figure for Alabama.

TABLE 14.—*Comparison of the production of bituminous coal in 1913, 1920, 1923, and 1924, by groups of States* [a]

Group	Production (net tons)				Per cent of increase or decrease		
	1913	1920	1923	1924	1923 to 1924	1920 to 1924	1913 to 1924
Pennsylvania, Maryland, West Virginia, and Virginia	258, 643, 000	276, 022, 000	293, 827, 000	245, 154, 000	−16. 6	−11. 2	−5. 2
Eastern Kentucky, Ohio, and Michigan	48, 532, 000	71, 982, 000	75, 529, 000	67, 431, 000	−10. 7	−6. 3	+38. 9
Tennessee	6, 860, 000	6, 662, 000	6, 040, 000	4, 557, 000	−24. 6	−31. 6	−33. 6
Alabama	17, 679, 000	[b] 19,185, 000	20, 458, 000	19, 130, 000	−6. 5	[b] −. 3	+8. 2
Illinois, Indiana, and Western Kentucky	87, 303, 000	129, 152, 000	116, 446, 000	98, 824, 000	−15. 1	−23. 5	+13. 2
North Dakota, South Dakota, Iowa, Missouri, Kansas, Oklahoma, Arkansas, and Texas	28, 381, 000	28, 639, 000	20, 322, 000	18, 338, 000	−9. 8	−36. 0	−35. 4
Colorado, Montana, Wyoming, Utah, and New Mexico	26, 830, 000	36, 011, 000	28, 704, 000	27, 381, 000	−4. 6	−22. 7	+2. 1
Washington	3, 878, 000	3, 757, 000	2, 926, 000	2, 654, 000	−9. 3	−29. 4	−31. 6

[a] Does not include production in Alaska, California, Georgia, Idaho, Nebraska, Nevada, North Carolina, and Oregon.
[b] Because Alabama was affected by a strike in 1920, the production of 1918 is used for comparison.

TABLE 15.—*Coal produced in 1924, by States, and highest recorded production*

State	1924 (net tons)	Maximum production	
		Year	Net tons
Alabama	19, 130, 184	1923	20, 457, 649
Alaska	99, 663	1923	119, 826
Arkansas	1, 451, 503	1907	2, 670, 438
California, Idaho, Nebraska, and Oregon	16, 953	1880	280, 155
Colorado	10, 444, 098	1917	12, 483, 336
Georgia	74, 947	1903	416, 951
Illinois	68, 323, 281	1918	89, 291, 105
Indiana	21, 480, 213	1918	30, 678, 634
Iowa	5, 468, 450	1917	8, 965, 830
Kansas	4, 247, 733	1918	7, 561, 947
Kentucky	45, 147, 204	1924	45, 147, 204
Maryland	2, 133, 703	1907	5, 532, 628
Michigan	831, 020	1907	2, 035, 858
Missouri	2, 480, 880	1917	5, 670, 549
Montana	2, 905, 365	1918	4, 532, 505
New Mexico	2, 786, 063	1918	4, 023, 239
North Carolina	57, 094	1922	78, 570
North Dakota	1, 200, 527	1923	1, 385, 400
Ohio	30, 473, 007	1920	45, 878, 191
Oklahoma	2, 329, 615	1920	4, 849, 288
Pennsylvania (bituminous)	130, 633, 773	1918	178, 550, 741
South Dakota	12, 043	1919	14, 417
Tennessee	4, 556, 555	1910	7, 121, 380
Texas	1, 147, 011	1913	2, 429, 144
Utah	4, 488, 157	1920	6, 005, 199
Virginia	10, 693, 464	1923	11, 761, 643
Washington	2, 653, 667	1918	4, 082, 212
West Virginia	101, 662, 897	1923	107, 899, 941
Wyoming	6, 757, 468	1920	9, 630, 271
Pennsylvania (anthracite)	87, 926, 862	1917	99, 611, 811

TABLE 16.—*Bituminous coal produced and number of mines active in the several fields adopted by the United States Coal Commission, 1922–1924*

[Exclusive of product of wagon mines]

Coal Commission field number	State	General name of field	1922		1923		1924	
			Number of mines	Net tons	Number of mines	Net tons	Number of mines	Net tons
1	Pennsylvania	Pittsburgh	430	21, 924, 000	452	42, 209, 000	317	30, 965, 000
2	do	Connellsville	336	22, 625, 000	312	37, 882, 000	208	29, 809, 000
3	do	Westmoreland-Ligonier	184	13, 189, 000	171	14, 563, 000	125	11, 104, 000
4a	do	Freeport-thin	122	6, 762, 000	123	12, 338, 000	103	7, 946, 000
4b	do	Freeport-thick						
5	do	Butler-Mercer	107	2, 606, 000	110	2, 587, 000	87	2, 009, 000
6	do	Blossburg	20	391, 000	20	496, 000	20	301, 000
7	do	Broad Top	59	774, 000	63	1, 430, 000	57	1, 149, 000
8	do	Somerset	248	6, 117, 000	232	5, 772, 000	168	5, 617, 000
9a	do	Central Pennsylvania, western.	1, 369	37, 314, 000	1, 385	54, 364, 000	1, 037	41, 734, 000
9b	do	Central Pennsylvania, middle.						
9c	do	Central Pennsylvania, eastern.						
10	Maryland-West Virginia.	Maryland-Potomac	143	2, 315, 000	159	3, 890, 000	133	3, 211, 000
11	West Virginia	Fairmont	298	11, 250, 000	309	22, 883, 000	203	16, 965, 000
12	Ohio-West Virginia.	Panhandle-Pittsburgh No. 8.	231	16, 341, 000	233	25, 529, 000	204	21, 388, 000
13	do	Pomeroy	42	696, 000	41	1, 309, 000	30	299, 000
14	West Virginia	Putnam County	11	209, 000	10	345, 000	4	86, 000
15	Kentucky-West Virginia.	Kenova	46	1, 519, 000	38	2, 103, 000	26	2, 545, 000
16	do	Thacker	88	5, 615, 000	89	6, 149, 000	61	6, 566, 000
17	West Virginia	Tug River	84	4, 535, 000	87	4, 555, 000	70	5, 351, 000
18	West Virginia-Virginia.	Pocahontas	109	16, 958, 000	107	16, 481, 000	92	17, 143, 000
19	West Virginia	Winding Gulf	85	7, 220, 000	78	7, 228, 000	72	8, 055, 000
20	do	New River	134	6, 184, 000	145	8, 810, 000	119	8, 775, 000
21	do	Kanawha	260	5, 721, 000	285	12, 741, 000	109	6, 370, 000
22	do	Coal River	24	945, 000	29	1, 397, 000	22	1, 566, 000
23	do	Logan	140	12, 738, 000	155	12, 831, 000	125	16, 604, 000
24a	do	Coal and Coke	39	1, 039, 000	39	1, 158, 000	14	904, 000
24b	do	Preston County	61	1, 662, 000	58	1, 937, 000	41	1, 397, 000
24c	do	Taylor County, Junior, Philippi, and Gauley.	178	3, 682, 000	176	6, 140, 000	206	7, 857, 000
25	Virginia	Southwestern Virginia	118	6, 849, 000	123	8, 148, 000	78	7, 179, 000

TABLE 16.—*Bituminous coal produced and number of mines active in the several fields adopted by the United States Coal Commission, 1922–1924*—Continued

Coal Commission field number	State	General name of field	1922		1923		1924	
			Number of mines	Net tons	Number of mines	Net tons	Number of mines	Net tons
26	Virginia	Clinch Valley	38	2,478,000	34	2,464,000	29	2,141,000
27	do	Upper New River	[a] 9	[a] 121,000	[a] 8	[a] 217,000	6	186,000
28	do	Richmond Basin	(a)	(a)	(a)	(a)	------	----------
29	Ohio	Massillon-Palmyra-Lisbon.	95	1,965,000	90	2,815,000	96	1,563,000
30	do	Coshocton-Goshen	163	2,400,000	155	3,174,000	140	2,639,000
31	do	Cambridge	58	2,697,000	55	4,780,000	42	3,401,000
32	do	Crooksville	62	815,000	60	1,015,000	55	712,000
33	do	Hocking	253	5,565,000	241	7,517,000	181	5,494,000
34	do	Jackson and Ironton	99	650,000	89	610,000	55	448,000
36	Kentucky	Northeast Kentucky	227	8,447,000	225	9,602,000	185	11,333,000
37	do	Hazard	138	5,820,000	128	6,660,000	92	6,814,000
38	do	Harlan	81	6,347,000	75	8,752,000	65	9,572,000
39	Kentucky-Tennessee.	Southern Appalachian	215	5,306,000	221	6,765,000	145	5,895,000
40	do	Jellico	57	731,000	55	1,003,000	42	1,055,000
41	Kentucky	Western Kentucky	210	13,734,000	172	10,890,000	164	9,020,000
42	Tennessee	Rockwood-Soddy	81	1,966,000	89	2,563,000	61	1,746,000
43	do	Fentress	11	488,000	13	541,000	10	387,000
44	Alabama	Big Seam group	50	4,895,000	45	5,954,000	42	5,525,000
45	Alabama-Georgia.	Cahaba group	107	5,216,000	109	5,846,000	95	5,463,000
46	Alabama	Pratt group	124	8,179,000	137	8,696,000	103	8,217,000
47	Indiana	Indiana	273	18,627,000	272	25,793,000	219	21,204,000
48	do	Brazil Block	23	323,000	29	345,000	29	276,000
49	Illinois	Northern Illinois	64	1,770,000	60	2,334,000	50	1,953,000
50	do	Fulton-Peoria	136	3,341,000	119	4,190,000	116	3,591,000
51	do	Danville	35	2,920,000	32	4,178,000	30	3,391,000
52	do	Central Illinois	112	18,774,000	108	25,205,000	90	20,994,000
53	do	Belleville	114	8,388,000	106	10,193,000	82	7,695,000
54	do	Murphysboro	10	223,000	10	557,000	6	692,000
55	do	Southern Illinois	140	22,962,000	140	32,595,000	114	30,007,000
56	Michigan	Michigan	13	929,000	13	1,172,000	9	831,000
57	Arkansas	Sebastian	67	867,000	54	899,000	45	981,000
58	do	Excelsior-Logan	18	80,000	22	112,000	24	191,000
59	do	Arkansas anthracite	17	139,000	18	222,000	17	280,000
60	Colorado	Colorado domestic	137	3,854,000	145	4,430,000	147	4,507,000
61	do	Trinidad	50	3,368,000	44	3,182,000	35	3,113,000
62	do	Northern Colorado	48	2,773,000	47	2,715,000	49	2,824,000
63	Iowa	Marion-Monroe-Polk	91	3,129,000	89	4,485,000	172	4,327,000
64	do	Appanoose	68	1,167,000	62	1,217,000	84	1,141,000
65	Kansas	Pittsburg	------	----------	------	----------	------	----------
66	do	Lightning Creek	113	2,607,000	192	4,135,000	196	4,050,000
67	do	Osage	18	91,000	27	115,000	30	122,000
68	do	Leavenworth [b]	3	142,000	4	137,000	3	127,000
69	Missouri	Southern Missouri [c]	94	1,844,000	79	2,114,000	63	1,579,000
70	do	Lafayette	67	941,000	69	1,141,000	63	851,000
71	do	Grundy	(c)	(c)	(c)	(c)	(c)	(c)
72	do	Platte	(b)	(b)	(b)	(b)	(b)	(b)
73	Montana	Montana	53	2,557,000	48	3,144,000	68	2,905,000
74	New Mexico	Gallup	12	668,000	13	939,000	14	1,074,000
75	do	Anthracite	8	239,000	11	248,000	11	220,000
76	do	Raton	17	2,181,000	15	1,678,000	14	1,460,000
76a	do	Monero	3	28,000	3	33,000	3	32,000
77	North Dakota	Southern North Dakota	61	839,000	72	910,000	79	726,000
78	do	Northern North Dakota	41	429,000	50	447,000	53	475,000
79	Oklahoma	McAlester vein	25	635,000	25	640,000	19	430,000
80	do	Oklahoma, eastern	103	2,148,000	90	2,200,000	75	1,900,000
81	Texas	Texas bituminous	11	265,000	10	175,000	9	163,000
82	do	Texas lignite	28	841,000	34	1,012,000	35	984,000
83	Utah	Utah	40	4,991,000	37	4,720,000	39	4,488,000
84	Washington	Kittitas County	12	1,053,000	12	1,358,000	13	1,057,000
85	do	Pierce-King bituminous	20	1,140,000	16	605,000	23	1,181,000
86	do	Lewis	15	384,000	28	963,000	22	416,000
87	Idaho	Wyoming	(d)	(d)	(d)	(d)	(d)	(d)
	Wyoming		62	5,958,000	62	7,559,000	62	6,757,000
88	South Dakota	South Dakota	15	8,000	15	10,000	16	12,000
89	Oregon	Oregon	(d)	(d)	(d)	(d)	(d)	(d)
90	California	California [d]	3	27,000	5	20,000	9	17,000
91	Nevada	Nevada	------	----------	------	----------	(d)	(d)
92	North Carolina	North Carolina	2	80,000	2	36,000	2	57,000
	Unclassified		13	79,000	12	120,000	8	100,000
	Total		9,299	418,809,000	9,331	563,422,000	7,586	483,687,000

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[a] Upper New River field includes Richmond Basin field (No. 28).
[b] Leavenworth field, Kansas, includes Platte field, Missouri (No. 72).
[c] Southern Missouri field includes Grundy field (No. 71).
[d] California includes Idaho, Nevada (1924), and Oregon.

PRODUCTION, BY WEEKS AND MONTHS

TABLE 17.—*Estimated weekly production of bituminous coal, 1922–1924*

1922		1923		1924	
Week ended—	Net tons	Week ended—	Net tons	Week ended—	Net tons
Jan. 7	7,739,000	Jan. 6	11,379,000	Jan. 5	[a] 7,777,000
14	8,594,000	13	11,611,000	12	12,348,000
21	9,091,000	20	11,308,000	19	12,002,000
28	9,953,000	27	11,371,000	26	11,961,000
Feb. 4	10,056,000	Feb. 3	11,061,000	Feb. 2	11,726,000
11	10,672,000	10	11,102,000	9	11,901,000
18	10,647,000	17	10,798,000	16	11,538,000
25	10,768,000	24	10,687,000	23	10,706,000
Mar. 4	10,912,000	Mar. 3	11,330,000	Mar. 1	11,070,000
11	11,493,000	10	11,001,000	8	9,952,000
18	11,225,000	17	10,795,000	15	9,951,000
25	11,851,000	24	10,791,000	22	9,581,000
Apr. 1	10,838,000	31	10,797,000	29	9,130,000
8	3,970,000	Apr. 7	9,967,000	Apr. 5	7,047,000
15	3,785,000	14	10,767,000	12	6,989,000
22	3,701,000	21	10,580,000	19	7,148,000
29	4,322,000	28	10,459,000	26	6,950,000
May 6	4,311,000	May 5	10,414,000	May 3	7,069,000
13	4,589,000	12	10,533,000	10	7,366,000
20	4,639,000	19	10,631,000	17	7,269,000
27	5,061,000	26	11,437,000	24	7,403,000
June 3	4,779,000	June 2	10,446,000	31	6,918,000
10	5,317,000	9	11,051,000	June 7	7,622,000
17	5,189,000	16	10,945,000	14	7,391,000
24	5,552,000	23	10,789,000	21	7,440,000
July 1	5,410,000	30	10,825,000	28	7,614,000
8	3,807,000	July 7	9,050,000	July 5	5,918,000
15	4,268,000	14	11,309,000	12	7,749,000
22	3,822,000	21	11,051,000	19	7,651,000
29	4,091,000	28	11,197,000	26	7,792,000
Aug. 5	4,465,000	Aug. 4	10,936,000	Aug. 2	7,730,000
12	4,768,000	11	10,197,000	9	8,043,000
19	4,772,000	18	11,224,000	16	8,174,000
26	6,973,000	25	11,783,000	23	8,589,000
Sept. 2	9,688,000	Sept. 1	12,150,000	30	9,014,000
9	9,100,000	8	10,854,000	Sept. 6	8,215,000
16	10,080,000	15	11,777,000	13	9,843,000
23	10,090,000	22	11,856,000	20	10,165,000
30	10,168,000	29	11,745,000	27	10,467,000
Oct. 7	10,079,000	Oct. 6	11,075,000	Oct. 4	10,623,000
14	10,466,000	13	11,338,000	11	10,913,000
21	10,743,000	20	11,070,000	18	10,608,000
28	11,059,000	27	11,303,000	25	10,654,000
Nov. 4	11,041,000	Nov. 3	10,917,000	Nov. 1	10,414,000
11	10,504,000	10	11,103,000	8	9,703,000
18	11,610,000	17	10,058,000	15	10,475,000
25	11,491,000	24	10,518,000	22	10,919,000
Dec. 2	10,753,000	Dec. 1	9,256,000	29	9,893,000
9	11,900,000	8	10,174,000	Dec. 6	10,840,000
16	11,042,000	15	10,285,000	13	10,882,000
23	10,495,000	22	10,914,000	20	10,823,000
30	10,529,000	29	6,949,000	27	7,546,000
		Jan. 5	[a] 1,601,000	Jan. 3	[a] 6,175,000
	422,268,000		564,565,000		483,687,000

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[a] Figures represent that part of the output in the week which is included in the calendar year shown. The figures of total production for these weeks are as follows: Jan. 5, 1924, 9,378,000 tons; Jan. 3, 1925, 10,785,000 tons.

TABLE 18.—*Number of working days and estimated average production of bituminous coal per working day in each week, 1923–24*

Week ended—	Number of working days	Average production (net tons)	Week ended—	Number of working days	Average production (net tons)
1923			1924		
Jan. 6	5.3	2,147,000	Jan. 5	[a] 4.2	[b] 1,803,000
13	6	1,935,000	12	6	2,058,000
20	6	1,885,000	19	6	2,000,000
27	6	1,895,000	26	6	1,994,000
Feb. 3	6	1,844,000	Feb. 2	6	1,954,000
10	6	1,850,000	9	6	1,984,000
17	6	1,799,000	16	6	1,923,000
24	5.9	1,811,000	23	5.8	1,846,000
Mar. 3	6	1,888,000	Mar. 1	6	1,845,000
10	6	1,834,000	8	6	1,659,000
17	6	1,799,000	15	6	1,659,000
24	6	1,799,000	22	6	1,597,000
31	6	1,799,000	29	6	1,522,000
Apr. 7	5.4	1,846,000	Apr. 5	5.5	1,281,000
14	6	1,794,000	12	6	1,165,000
21	6	1,763,000	19	6	1,191,000
28	6	1,743,000	26	6	1,158,000
May 5	6	1,736,000	May 3	6	1,178,000
12	6	1,755,000	10	6	1,228,000
19	6	1,772,000	17	6	1,212,000
26	6	1,906,000	24	6	1,234,000
June 2	5.3	1,971,000	31	5.4	1,281,000
9	6	1,842,000	June 7	6	1,270,000
16	6	1,824,000	14	6	1,232,000
23	6	1,798,000	21	6	1,240,000
30	6	1,804,000	28	6	1,269,000
July 7	5	1,810,000	July 5	5	1,184,000
14	6	1,885,000	12	6	1,292,000
21	6	1,842,000	19	6	1,275,000
28	6	1,866,000	26	6	1,299,000
Aug. 4	6	1,823,000	Aug. 2	6	1,288,000
11	5.3	1,924,000	9	6	1,341,000
18	6	1,871,000	16	6	1,362,000
25	6	1,964,000	23	6	1,432,000
Sept. 1	6	2,025,000	30	6	1,502,000
8	5.3	2,048,000	Sept. 6	5.3	1,550,000
15	6	1,963,000	13	6	1,641,000
22	6	1,976,000	20	6	1,694,000
29	6	1,958,000	27	6	1,745,000
Oct. 6	6	1,846,000	Oct. 4	6	1,771,000
13	6	1,890,000	11	6	1,819,000
20	6	1,845,000	18	6	1,768,000
27	6	1,884,000	25	6	1,776,000
Nov. 3	6	1,820,000	Nov. 1	6	1,736,000
10	6	1,851,000	8	5.4	1,797,000
17	5.4	1,863,000	15	5.6	1,871,000
24	6	1,753,000	22	6	1,820,000
Dec. 1	5.1	1,815,000	29	5.2	1,914,000
8	6	1,696,000	Dec. 6	6	1,807,000
15	6	1,714,000	13	6	1,814,000
22	6	1,819,000	20	6	1,804,000
29	5	1,390,000	27	5	1,509,000
Jan. 5	[a] 1	[b] 1,803,000	Jan. 3	[a] 3	[b] 2,035,000
	306.0	1,845,000		307.4	1,573,000

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[a] Number of working days in this week that fell in the year.
[b] Average daily production for the entire week and not for the working days that fell in the year.

TABLE 19.—*Estimated weekly production of anthracite, 1923–24*

Week ended—	Production (net tons)	Number of working days	Average production per working day (net tons)	Week ended—	Production (net tons)	Number of working days	Average production per working day (net tons)
1923				1924			
Jan. 6	1,669,000	5	334,000	Jan. 5	[a]1,079,000	[a]4	[b][c]280,000
13	2,044,000	6	341,000	12	1,793,000	6	299,000
20	1,944,000	6	324,000	19	1,836,000	6	306,000
27	2,050,000	6	342,000	26	1,737,000	6	290,000
Feb. 3	1,989,000	6	332,000	Feb. 2	1,845,000	6	308,000
10	1,957,000	6	326,000	9	1,858,000	6	310,000
17	1,768,000	6	295,000	16	1,852,000	6	309,000
24	1,778,000	6	296,000	23	1,613,000	6	269,000
Mar. 3	2,035,000	6	339,000	Mar. 1	1,819,000	6	303,000
10	1,982,000	6	330,000	8	1,834,000	6	306,000
17	1,990,000	6	332,000	15	1,892,000	6	315,000
24	2,057,000	6	343,000	22	1,758,000	6	293,000
31	1,942,000	6	324,000	29	1,893,000	6	316,000
Apr. 7	1,550,000	5	310,000	Apr. 5	1,509,000	5	302,000
14	2,000,000	6	333,000	12	1,809,000	6	302,000
21	1,998,000	6	333,000	19	1,582,000	6	264,000
28	2,047,000	6	341,000	26	1,174,000	6	196,000
May 5	1,955,000	6	326,000	May 3	1,575,000	6	263,000
12	1,841,000	6	307,000	10	1,875,000	6	313,000
19	1,978,000	6	330,000	17	1,850,000	6	308,000
26	1,892,000	6	315,000	24	1,803,000	6	301,000
June 2	1,553,000	5	311,000	31	1,261,000	5	252,000
9	1,979,000	6	330,000	June 7	1,799,000	6	300,000
16	1,986,000	6	331,000	14	1,777,000	6	296,000
23	1,975,000	6	329,000	21	1,777,000	6	296,000
30	2,036,000	6	339,000	28	1,869,000	6	312,000
July 7	1,528,000	5	306,000	July 5	1,263,000	5	253,000
14	1,984,000	6	331,000	12	1,823,000	6	304,000
21	1,939,000	6	323,000	19	1,793,000	6	299,000
28	2,012,000	6	201,000	26	1,790,000	6	298,000
Aug. 4	1,952,000	6	325,000	Aug. 2	1,676,000	6	279,000
11	1,678,000	6	280,000	9	1,622,000	6	270,000
18	1,797,000	6	300,000	16	1,351,000	6	225,000
25	2,094,000	6	349,000	23	1,668,000	6	278,000
Sept. 1	1,831,000	6	305,000	30	1,790,000	6	298,000
8	3,000	5	600	Sept. 6	1,414,000	5	283,000
15	2,000	6	300	13	1,774,000	6	296,000
22	848,000	6	141,000	20	1,804,000	6	301,000
29	1,959,000	6	327,000	27	1,893,000	6	316,000
Oct. 6	1,949,000	6	325,000	Oct. 4	1,389,000	6	232,000
13	1,943,000	6	324,000	11	1,693,000	6	282,000
20	1,978,000	6	330,000	18	1,706,000	6	284,000
27	2,001,000	6	334,000	25	1,878,000	6	313,000
Nov. 3	1,328,000	5	266,000	Nov. 1	1,407,000	5	281,000
10	1,903,000	6	317,000	8	1,552,000	5	310,000
17	1,669,000	5	334,000	15	1,632,000	5	326,000
24	2,031,000	6	339,000	22	1,781,000	6	297,000
Dec. 1	1,691,000	5	338,000	29	1,570,000	5	314,000
8	1,837,000	6	306,000	Dec. 6	1,768,000	6	295,000
15	1,947,000	6	325,000	13	1,727,000	6	288,000
22	1,925,000	6	321,000	20	1,820,000	6	303,000
29	1,196,000	5	239,000	27	1,003,000	5	201,000
Jan. 5	[a]319,000	[a]1	[b][c]280,000	Jan. 3	[a]871,000	[a]3	[b]244,000
	93,339,000	304	307,000		87,927,000	304	289,000

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[a] Figures represent the output and the number of working days in that part of the week included in the calendar year shown.

[b] Average daily production for the entire week and not for the working days that fell in the year

[c] Revised figures.

TABLE 20.—*Estimated monthly production of bituminous coal and average production per working day, 1916–1924, in net tons*

Month	1916		1917		1918	
	Total	Daily average	Total	Daily average	Total	Daily average
January	46,593,000	1,864,000	47,969,000	1,845,000	42,227,000	1,624,000
February	45,187,000	1,807,000	41,353,000	1,723,000	43,777,000	1,824,000
March	43,828,000	1,623,000	47,869,000	1,773,000	48,113,000	1,851,000
April	33,628,000	1,345,000	41,854,000	1,674,000	46,041,000	1,771,000
May	38,804,000	1,437,000	47,086,000	1,744,000	50,443,000	1,868,000
June	37,742,000	1,452,000	46,824,000	1,873,000	51,138,000	2,046,000
July	38,113,000	1,525,000	46,292,000	1,852,000	54,971,000	2,114,000
August	42,696,000	1,581,000	47,372,000	1,755,000	55,114,000	2,041,000
September	42,098,000	1,619,000	45,108,000	1,880,000	51,183,000	2,133,000
October	44,807,000	1,723,000	48,337,000	1,790,000	52,300,000	1,937,000
November	44,927,000	1,872,000	47,690,000	1,908,000	43,895,000	1,756,000
December	44,097,000	1,764,000	44,037,000	1,761,000	40,184,000	1,607,000
	502,520,000	1,632,000	551,791,000	1,797,000	579,386,000	1,881,000

Month	1919		1920		1921	
	Total	Daily average	Total	Daily average	Total	Daily average
January	42,193,000	1,623,000	49,748,000	1,913,000	41,148,000	1,646,000
February	32,103,000	1,338,000	41,055,000	1,711,000	31,524,000	1,314,000
March	34,293,000	1,319,000	47,850,000	1,772,000	31,054,000	1,150,000
April	32,712,000	1,258,000	38,764,000	1,491,000	28,154,000	1,083,000
May	38,186,000	1,414,000	39,841,000	1,532,000	34.057,000	1,362,000
June	37,685,000	1,507,000	46,095,000	1,773,000	34,635,000	1,332,000
July	43,425,000	1,670,000	45,988,000	1,769,000	31,047,000	1,242,000
August	43,613,000	1,677,000	49,974,000	1,922,000	35,291,000	1,307,000
September	48,209,000	1,928,000	50,241,000	2,010,000	35,870,000	1,380,000
October	57,200,000	2,119,000	53,278,000	2,049.000	44,687,000	1,719,000
November	19,006,000	792,000	52,576,000	2,103,000	36,805,000	1,472,000
December	37,235,000	1,432,000	53,257,000	2,048,000	31,650,000	1,217,000
	465,860,000	1,512,000	568,667,000	1,847,000	415,922,000	1,356,000

Month	1922		1923		1924	
	Total	Daily average	Total	Daily average	Total	Daily average
January	38,930,000	1,545,000	51,944,000	1,975,000	52,507,000	2,004,000
February	42,425,000	1,768,000	43,645,000	1,826,000	47,302,000	1,907,000
March	51,936,000	1,924,000	48,446,000	1,794,000	41,288,000	1,588,000
April	16,335,000	672,000	44,057,000	1,806,000	30,429,000	1,193,000
May	21,005,000	784,000	47,690,000	1,813,000	32,276,000	1,223,000
June	23,096,000	888,000	47,083,000	1,811,000	31,458,000	1,258,000
July	17,602,000	704,000	46,707,000	1,868,000	33,346,000	1,283,000
August	26,755,000	991,000	50,578,000	1,923,000	35,923,000	1,382,000
September	42,463,000	1,678,000	47,841,000	1,969,000	42,376,000	1,675,000
October	46,733,000	1,797,000	50,907,000	1,885,000	48,414,000	1,793,000
November	46,900,000	1,899,000	44,425,000	1,813,000	42,102,000	1,815,000
December	48,088,000	1,924,000	41,242,000	1,650,000	46,266,000	1,779,000
	422,268,000	1,379,000	564,565,000	1,845,000	483,687,000	1,573,000

Table 21.—*Estimated monthly production of bituminous coal, by States, in 1924, in net tons*

State	January	February	March	April	May	June	July
Alabama	1, 929, 000	1, 727, 000	1, 640, 000	1, 304, 000	1, 317, 000	1, 271, 000	1, 332, 000
Arkansas	178, 000	133, 000	114, 000	59, 000	74, 000	81, 000	98, 000
Colorado	1, 232, 000	897, 000	906, 000	732, 000	687, 000	577, 000	625, 000
Illinois	9, 176, 000	7, 195, 000	5, 647, 000	3, 649, 000	3, 700, 000	3, 654, 000	4, 074, 000
Indiana	2, 685, 000	2, 326, 000	1, 828, 000	1, 184, 000	1, 341, 000	1, 247, 000	1, 350, 000
Iowa	730, 000	600, 000	473, 000	320, 000	310, 000	303, 000	337, 000
Kansas	509, 000	385, 000	363, 000	219, 000	238, 000	264, 000	298, 000
Kentucky:							
Eastern	3, 180, 000	3, 106, 000	2, 760, 000	2, 318, 000	2, 598, 000	2, 482, 000	2, 705, 000
Western	1, 165, 000	946, 000	880, 000	526, 000	397, 000	458, 000	525, 000
Maryland	229, 000	201, 000	201, 000	140, 000	139, 000	145, 000	142, 000
Michigan	117, 000	96, 000	75, 000	51, 000	52, 000	33, 000	57, 000
Missouri	341, 600	259, 000	239, 000	117, 000	126, 000	135, 000	156, 000
Montana	419, 000	292, 000	233, 000	176, 000	148, 000	121, 000	146, 000
New Mexico	293, 000	223, 000	227, 000	204, 000	198, 000	192, 000	204, 000
North Dakota	173, 000	120, 000	95, 000	69, 000	62, 000	51, 000	58, 000
Ohio	3, 439, 000	3, 234, 000	2, 714, 000	1, 916, 000	2, 081, 000	1, 975, 000	2, 060, 000
Oklahoma	296, 000	213, 000	203, 000	120, 000	130, 000	139, 000	172, 000
Pennsylvania	14, 020, 000	13, 635, 000	12, 239, 000	8, 976, 000	9, 374, 000	8, 922, 000	8, 813, 000
Tennessee	488, 000	454, 000	446, 000	277, 000	269, 000	258, 000	292, 000
Texas	113, 000	92, 000	82, 000	75, 000	84, 000	81, 000	89, 000
Utah	528, 000	314, 000	293, 000	307, 000	273, 000	270, 000	353, 000
Virginia	956, 000	1, 000, 000	893, 000	751, 000	766, 000	753, 000	832, 000
Washington	340, 000	245, 000	225, 000	198, 000	169, 000	155, 000	171, 000
West Virginia	9, 080, 000	9, 013, 000	7, 914, 000	6, 303, 000	7, 350, 000	7, 539, 000	8, 051, 000
Wyoming	870, 000	572, 000	576, 000	416, 000	369, 000	330, 000	387, 000
Other States	21, 000	24, 000	22, 000	22, 000	24, 000	22, 000	19, 000
	52, 507, 000	47, 302, 000	41, 288, 000	30, 429, 000	32, 276, 000	31, 458, 000	33, 346, 000

State	August	September	October	November	December	Total
Alabama	1, 447, 000	1, 693, 000	1, 928, 000	1, 712, 000	1, 830, 000	19, 130, 000
Arkansas	113, 000	152, 000	163, 000	126, 000	161, 000	1, 452, 000
Colorado	716, 000	948, 000	1, 072, 000	1, 003, 000	1, 049, 000	10, 444, 000
Illinois	4, 729, 000	6, 285, 000	6, 968, 000	5, 925, 000	7, 321, 000	68, 323, 000
Indiana	1, 506, 000	1, 921, 000	2, 030, 000	1, 799, 000	2, 263, 000	21, 480, 000
Iowa	352, 000	470, 000	535, 000	464, 000	574, 000	5, 468, 000
Kansas	324, 000	392, 000	448, 000	373, 000	435, 000	4, 248, 000
Kentucky:						
Eastern	2, 906, 000	3, 356, 000	3, 838, 000	3, 479, 000	3, 399, 000	36, 127, 000
Western	656, 000	845, 000	968, 000	775, 000	879, 000	9, 020, 000
Maryland	155, 000	174, 000	195, 000	190, 000	223, 000	2, 134, 000
Michigan	57, 000	63, 000	87, 000	61, 000	82, 000	831, 000
Missouri	172, 000	219, 000	250, 000	211, 000	256, 000	2, 481, 000
Montana	175, 000	233, 000	306, 000	309, 000	347, 000	2, 905, 000
New Mexico	221, 000	243, 000	274, 000	244, 000	263, 000	2, 786, 000
North Dakota	60, 000	85, 000	128, 000	146, 000	154, 000	1, 201, 000
Ohio	2, 171, 000	2, 576, 000	2, 993, 000	2, 603, 000	2, 711, 000	30, 473, 000
Oklahoma	182, 000	219, 000	241, 000	193, 000	222, 000	2, 330, 000
Pennsylvania	9, 221, 000	10, 638, 000	12, 214, 000	10, 539, 000	12, 043, 000	130, 634, 000
Tennessee	327, 000	393, 000	465, 000	416, 000	472, 000	4, 557, 000
Texas	107, 000	112, 000	122, 000	94, 000	96, 000	1, 147, 000
Utah	372, 000	387, 000	473, 000	427, 000	491, 000	4, 488, 000
Virginia	860, 000	927, 000	1, 050, 000	938, 000	967, 000	10, 693, 000
Washington	170, 000	212, 000	266, 000	238, 000	265, 000	2, 654, 000
West Virginia	8, 431, 000	9, 168, 000	10, 639, 000	9, 192, 000	8, 983, 000	101, 663, 000
Wyoming	474, 000	644, 000	737, 000	624, 000	758, 000	6, 757, 000
Other States	19, 000	21, 000	24, 000	21, 000	22, 000	261, 000
	35, 923, 000	42, 376, 000	48, 414, 000	42, 102, 000	46, 266, 000	483, 687, 000

TABLE 22.—*Estimated daily output of bituminous coal, by States, in each month of 1923 and 1924, in net tons*

[The figures represent the average per working day. The total number of working days for the country as a whole was 306 in 1923 and 307 in 1924]

State	January	February	March	April	May	June	July
1923							
Alabama	72, 300	68, 200	70, 500	68, 700	66, 400	64, 500	64, 800
Arkansas	5, 100	4, 200	3, 700	3, 500	3, 300	3, 700	4, 200
Colorado	37, 700	38, 500	32, 600	30, 700	28, 000	29, 200	27, 600
Illinois	351, 900	332, 100	280, 600	245, 200	215, 400	207, 200	211, 400
Indiana	109, 900	102, 100	95, 800	85, 600	65, 600	69, 300	75, 100
Iowa	23, 300	22, 700	20, 400	16, 600	14, 900	14, 700	14, 600
Kansas	17, 100	15, 800	14, 000	13, 100	12, 500	12, 200	12, 700
Kentucky:							
Eastern	101, 200	92, 700	93, 500	103, 200	113, 100	110, 200	122, 400
Western	40, 000	37, 700	35, 700	31, 400	30, 500	30, 400	33, 700
Maryland	9, 100	8, 500	8, 700	8, 700	7, 900	7, 800	7, 000
Michigan	5, 400	4, 400	5, 300	3, 700	2, 000	2, 000	2, 800
Missouri	14, 500	13, 200	10, 000	9, 800	9, 400	9, 100	9, 700
Montana	13, 700	13, 300	11, 400	7, 000	7, 100	6, 300	6, 800
New Mexico	12, 100	9, 700	8, 900	9, 900	9, 600	8, 500	8, 700
North Dakota	8, 400	6, 200	5, 700	2, 600	2, 400	2, 300	2, 400
Ohio	135, 600	115, 600	123, 300	127, 600	143, 400	148, 000	142, 400
Oklahoma	10, 300	10, 300	9, 200	8, 200	7, 600	8, 000	8, 100
Pennsylvania	567, 000	514, 600	541, 500	588, 400	596, 400	602, 200	613, 300
Tennessee	22, 200	21, 100	19, 700	20, 100	20, 100	18, 900	18, 800
Texas	4, 300	3, 900	3, 200	3, 300	3, 600	3, 500	3, 900
Utah	18, 200	16, 000	11, 300	11, 600	12, 300	14, 800	14, 500
Virginia	35, 200	35, 400	38, 300	41, 500	41, 700	39, 900	39, 900
Washington	12, 400	12, 800	12, 300	5, 900	7, 300	7, 400	6, 100
West Virginia	316, 000	300, 000	314, 900	339, 000	373, 600	372, 600	397, 500
Wyoming	31, 100	26, 000	22, 600	19, 300	18, 400	17, 400	19, 100
Other States	1, 100	1, 100	1, 200	1, 000	800	800	700
	1, 975, 000	1, 826, 000	1, 794, 000	1, 806, 000	1, 813, 000	1, 811, 000	1, 868, 000

State	August	September	October	November	December	Total
1923						
Alabama	66, 200	67, 600	66, 400	68, 200	58, 200	66, 900
Arkansas	4, 400	5, 200	4, 700	4, 700	4, 200	4, 200
Colorado	28, 800	35, 600	36, 200	39, 300	42, 200	33, 800
Illinois	227, 100	264, 400	259, 800	261, 900	255, 800	259, 200
Indiana	73, 300	91, 600	86, 600	89, 300	85, 700	85, 700
Iowa	16, 700	19, 500	19, 400	21, 400	20, 200	18, 700
Kansas	14, 000	15, 800	15, 200	17, 000	15, 000	14, 500
Kentucky:						
Eastern	127, 500	118, 800	127, 400	120, 700	97, 400	110, 700
Western	36, 100	41, 400	39, 800	36, 300	33, 900	35, 600
Maryland	7, 400	6, 700	5, 900	5, 900	6, 100	7, 500
Michigan	3, 500	4, 500	4, 700	4, 300	3, 400	3, 800
Missouri	10, 200	12, 200	11, 700	12, 200	11, 500	11, 100
Montana	8, 300	11, 300	13, 700	13, 900	10, 600	10, 300
New Mexico	8, 200	9, 400	9, 600	10, 300	9, 400	9, 500
North Dakota	3, 400	4, 500	6, 000	5, 800	4, 500	4, 500
Ohio	145, 100	143, 500	136, 100	127, 300	99, 800	132, 500
Oklahoma	9, 200	10, 800	10, 100	12, 000	9, 700	9, 400
Pennsylvania	622, 400	597, 400	524, 800	498, 900	469, 600	561, 700
Tennessee	19, 700	19, 900	19, 600	19, 600	17, 100	19, 800
Texas	4, 000	4, 300	4, 300	4, 800	3, 500	3, 900
Utah	13, 900	17. 200	20, 200	18, 700	16, 600	15, 400
Virginia	41, 400	40, 800	38, 500	36, 200	32, 100	38, 400
Washington	7, 800	9, 700	11, 300	12, 000	9, 500	9, 600
West Virginia	398, 300	388, 500	382, 200	341, 200	304, 000	352, 600
Wyoming	25, 600	27, 500	30, 700	30, 600	28, 900	24, 800
Other States	600	600	600	800	800	900
	1, 923, 000	1, 969, 000	1, 885, 000	1, 813, 000	1, 650, 000	1, 845, 000

TABLE 22.—*Estimated daily output of bituminous coal, by States, in each month of 1923 and 1924, in net tons*—Continued

State	January	February	March	April	May	June	July
1924							
Alabama	73, 600	69, 600	63, 000	51, 100	50, 000	50, 800	51, 200
Arkansas	6, 800	5, 400	4, 400	2, 300	3, 600	3, 200	3, 800
Colorado	47, 000	36, 200	34, 800	28, 700	26, 000	23, 100	24, 000
Illinois	350, 200	290, 100	217, 200	143, 100	140, 200	146, 200	156, 700
Indiana	102, 500	93, 800	70, 300	46, 400	50, 800	49, 900	51, 900
Iowa	27, 900	24, 200	18, 200	12, 500	11, 700	12, 100	13, 000
Kansas	19, 400	15, 500	14, 000	8, 600	9, 000	10, 600	11, 500
Kentucky:							
Eastern	121, 400	125, 200	106, 200	90, 900	98, 400	99, 300	104, 000
Western	44, 500	38, 100	33, 800	20, 600	15, 000	18, 300	20, 200
Maryland	8, 700	8, 100	7, 700	5, 500	5, 300	5, 800	5, 500
Michigan	4, 500	3, 900	2, 900	2, 000	2, 000	1, 300	2, 200
Missouri	13, 000	10, 400	9, 200	4, 600	4, 800	5, 400	6, 000
Montana	16, 000	11, 800	9, 000	6, 900	5, 600	4, 800	5, 600
New Mexico	11, 200	9, 000	8, 700	8, 000	7, 500	7, 700	7, 800
North Dakota	6, 600	4, 800	3, 700	2, 700	2, 300	2, 000	2, 200
Ohio	131, 300	130, 400	104, 400	75, 100	78, 800	79, 000	79, 200
Oklahoma	11, 300	8, 600	7, 800	4, 700	4, 900	5, 600	6, 600
Pennsylvania	535, 100	549, 800	470, 700	352, 000	355, 100	356, 900	339, 000
Tennessee	18, 600	18, 300	17, 200	10, 900	10, 200	10, 300	11, 200
Texas	4, 300	3, 700	3, 200	2, 900	3, 200	3, 200	3, 400
Utah	20, 200	12, 700	11, 300	12, 000	10, 300	10, 800	13, 600
Virginia	36, 500	40, 300	34, 300	29, 500	29, 000	30, 100	32, 000
Washington	13, 000	9, 900	8, 700	7, 800	6, 400	6, 200	6, 600
West Virginia	346, 600	363, 400	304, 400	247, 200	278, 400	301, 600	309, 700
Wyoming	33, 200	23, 100	22, 200	16, 300	14, 000	13, 200	14, 900
Other States	800	1, 000	800	900	900	900	700
	2, 004, 000	1, 907, 000	1, 588, 000	1, 193, 000	1, 223, 000	1, 258, 000	1, 283, 000

State	August	September	October	November	December	Total
1924						
Alabama	55, 700	66, 900	71, 400	73, 800	70, 700	62, 200
Arkansas	3, 400	6, 000	6, 000	5, 400	6, 200	4, 700
Colorado	27, 500	37, 500	39, 700	43, 200	40, 300	34, 000
Illinois	181, 900	248, 400	258, 100	255, 400	281, 600	222, 300
Indiana	57, 900	75, 900	75, 200	77, 500	87, 000	69, 900
Iowa	13, 500	18, 600	19, 800	20, 000	22, 100	17, 800
Kansas	12, 500	15, 500	16, 600	16, 100	16, 700	13, 800
Kentucky:						
Eastern	111, 800	132, 600	142, 100	150, 000	130, 700	117, 500
Western	25, 200	33, 400	35, 900	33, 400	33, 800	29, 300
Maryland	6, 000	6, 900	7, 200	8, 200	8, 600	6, 900
Michigan	2, 200	2, 500	3, 200	2, 600	3, 200	2, 700
Missouri	6, 600	8, 700	9, 300	9, 100	9, 800	8, 100
Montana	6, 700	9, 200	11, 300	13, 300	13, 300	9, 500
New Mexico	8, 500	9, 600	10, 100	10, 500	10, 100	9, 100
North Dakota	2, 300	3, 400	4, 700	6, 300	5, 900	3, 900
Ohio	83, 500	101, 800	110, 900	112, 200	104, 300	99, 100
Oklahoma	7, 000	8, 700	8, 900	8, 300	8, 500	7, 600
Pennsylvania	354, 700	420, 500	452, 400	454, 300	463, 200	425, 000
Tennessee	12, 600	15, 500	17, 200	17, 900	18, 200	14, 800
Texas	4, 100	4, 400	4, 500	4, 100	3, 700	3, 700
Utah	14, 300	15, 300	17, 500	18, 400	18, 900	14, 600
Virginia	33, 100	36, 600	38, 900	40, 400	37, 200	34, 800
Washington	6, 500	8, 400	9, 900	10, 300	10, 200	8, 600
West Virginia	324, 300	362, 400	394, 000	396, 200	345, 500	330, 700
Wyoming	18, 200	25, 500	27, 300	26, 900	29, 200	22, 000
Other States	700	800	900	900	800	800
	1, 382, 000	1, 675, 000	1, 793, 000	1, 815, 000	1, 779, 000	1, 573, 000

TABLE 23.—*Estimated monthly production of anthracite and average production per working day, 1916–1924, in net tons*

Month	1916		1917		1918		1919	
	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average
January	7,649,000	306,000	7,672,000	295,000	7,270,000	280,000	7,819,000	301,000
February	7,404,000	296,000	6,688,000	279,000	7,494,000	312,000	5,102,000	213,000
March	7,964,000	295,000	9,026,000	334,000	9,382,000	361,000	5,190,000	200,000
April	5,887,000	[a] 245,000	7,222,000	[a] 301,000	8,211,000	[a] 328,000	6,884,000	275,000
May	7,212,000	[a] 277,000	8,933,000	[a] 343,000	8,880,000	[a] 342,000	7,525,000	289,000
June	7,327,000	282,000	9,103,000	[a] 350,000	8,855,000	354,000	7,404,000	296,000
July	7,062,000	282,000	8,684,000	347,000	9,134,000	351,000	7,974,000	307,000
August	7,190,000	266,000	9,058,000	335,000	9,258,000	343,000	8,096,000	311,000
September	7,206,000	[a] 288,000	8,230,000	343,000	8,038,000	335,000	7,494,000	300,000
October	7,630,000	[a] 305,000	9,183,000	[a] 353,000	8,105,000	[a] 312,000	8,645,000	333,000
November	7,790,000	[a] 312,000	8,453,000	338,000	6,803,000	272,000	7,870,000	342,000
December	7,257,000	290,000	7,360,000	294,000	7,396,000	296,000	8,089,000	311,000
	87,578,000	[a] 287,000	99,612,000	[a] 327,000	98,826,000	[a] 324,000	88,092,000	290,000

Month	1920		1921		1922		1923		1924	
	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average
January	7,459,000	287,000	7,681,000	307,000	6,566,000	263,000	8,521,000	328,000	7,724,000	297,000
February	6,415,000	267,000	7,983,000	333,000	7,096,000	296,000	7,602,000	317,000	7,428,000	297,000
March	7,935,000	294,000	7,677,000	284,000	9,181,000	340,000	9,175,000	340,000	7,908,000	304,000
April	6,285,000	251,000	7,985,000	319,000	27,000	1,000	7,885,000	329,000	6,639,000	265,000
May	8,037,000	321,000	7,752,000	310,000	36,000	1,000	8,384,000	322,000	7,549,000	290,000
June	8,251,000	317,000	8,071,000	310,000	86,000	3,000	8,474,000	326,000	7,509,000	300,000
July	8,342,000	321,000	7,309,000	292,000	118,000	5,000	8,136,000	325,000	7,584,000	292,000
August	8,105,000	312,000	7,459,000	276,000	164,000	6,000	8,672,000	321,000	6,906,000	266,000
September	4,691,000	188,000	7,385,000	295,000	5,075,000	203,000	2,853,000	119,000	7,408,000	296,000
October	8,148,000	326,000	7,858,000	314,000	8,896,000	356,000	8,532,000	328,000	7,479,000	288,000
November	7,527,000	314,000	7,110,000	296,000	8,695,000	362,000	7,575,000	316,000	6,604,000	287,000
December	8,403,000	323,000	6,203,000	239,000	8,743,000	350,000	7,530,000	301,000	7,189,000	277,000
	89,598,000	295,000	90,473,000	298,000	54,683,000	180,000	93,339,000	307,000	87,927,000	288,000

[a] Revised figures.

MEN EMPLOYED

TABLE 24.—*Comparative number of employees in bituminous coal mines, 1920, 1922, 1923, and 1924*

State	Average number employed				Per cent of increase or decrease		
	1920	1922	1923	1924	1923 to 1924	1922 to 1924	1920 to 1924
Alabama	[a] 25,540	28,169	30,035	27,956	−6.9	−0.7	[a] +9.5
Arkansas	3,966	4,035	3,754	3,350	−10.8	−16.9	−15.5
Colorado	13,711	13,506	13,340	12,954	−2.9	−4.1	−5.5
Illinois	87,084	96,336	99,714	89,363	−10.4	−7.2	+2.6
Indiana	31,155	33,208	35,408	27,558	−22.2	−17.0	−11.5
Iowa	11,905	12,857	11,448	12,101	+5.7	−5.9	+1.6
Kansas	[b] 8,984	[b] 7,359	9,761	8,561	−12.3	[b] +16.3	[b] −4.7
Kentucky	49,452	60,924	60,811	55,766	−8.3	−8.4	+12.8
Maryland	5,548	3,755	3,725	3,776	+1.4	+.6	−31.9
Michigan	2,154	2,166	1,977	1,551	−21.5	−28.4	−28.0
Missouri	8,838	8,750	6,952	5,977	−14.0	−31.7	−32.4
Montana	4,204	3,635	3,511	3,196	−9.0	−12.1	−24.0
New Mexico	3,738	4,001	4,095	4,206	+2.7	+5.1	+12.5
North Dakota	1,110	1,648	1,621	1,298	−19.9	−21.2	+16.9

[a] Because of the strike in Alabama in 1920, that year is not a fair standard of comparison. Against 1919, when the average number employed was 26,874, the year 1924 shows an increase of 4 per cent.

[b] Figures for Kansas in 1920 and 1922 are probably incomplete. In comparison with 1919, when 9,926 men were employed, the year 1924 shows a decrease of 13.8 per cent.

TABLE 24.—*Comparative number of employees in bituminous coal mines, 1920, 1922, 1923, and 1924*—Continued

State	Average number employed				Per cent of increase or decrease		
	1920	1922	1923	1924	1923 to 1924	1922 to 1924	1920 to 1924
Ohio	50, 857	54, 194	54, 555	44, 229	−18. 9	−18. 4	−13. 0
Oklahoma	8, 244	7, 828	7, 130	6, 144	−13. 8	−21. 5	−25. 5
Pennsylvania (bituminous)	173, 970	188, 838	194, 981	169, 322	−13. 2	−10. 3	−2. 7
Tennessee	11, 353	11, 449	11, 244	9, 365	−16. 7	−18. 2	−17. 5
Texas	2, 950	2, 841	2, 452	2, 195	−10. 5	−22. 7	−25. 6
Utah	4, 504	4, 721	4, 381	4, 330	−1. 2	−8. 3	−3. 9
Virginia	14, 010	13, 399	14, 120	12, 679	−10. 2	−5. 4	−9. 5
Washington	4, 994	4, 481	4, 306	3, 858	−10. 4	−13. 9	−22. 7
West Virginia	102, 950	110, 014	117, 300	102, 203	−12. 9	−7. 1	−. 7
Wyoming	7, 779	9, 045	7, 529	7, 113	−5. 8	−21. 4	−8. 5
Other States [a]	547	799	643	553	−14. 0	−30. 8	+1. 1
Total bituminous	639, 547	687, 958	704, 793	619, 604	−12. 1	−9. 9	−3. 1
Pennsylvania anthracite	145, 074	156, 849	157, 743	160, 009	+1. 4	+2. 0	+10. 3
Grand total	784, 621	844, 807	862, 536	779, 613	−9. 6	−7. 7	−. 6

[a] Includes Alaska, California, Georgia, Idaho, Nebraska (1924), North Carolina, Oregon, and South Dakota.

TABLE 25.—*Men employed underground and on the surface in coal mines, 1911–1924*

Year	Underground						Surface		Total number
	Miners, loaders, etc.		All others		Total underground		Number	Per cent	
	Number	Per cent	Number	Per cent	Number	Per cent			
Anthracite:									
1911	(a)	(a)	(a)	(a)	[b] 126, 541	72. 7	[b] 47, 399	27. 3	[b] 173, 940
1912	(a)	(a)	(a)	(a)	[c] 126, 606	72. 7	[c] 47, 424	27. 3	174, 030
1913	(a)	(a)	(a)	(a)	[c] 127, 854	72. 7	[c] 47, 891	27. 3	175, 745
1914	(a)	(a)	(a)	(a)	133, 309	74. 2	46, 370	25. 8	179, 679
1915	(a)	(a)	(a)	(a)	130, 963	74. 2	45, 589	25. 8	176, 552
1916	(a)	(a)	(a)	(a)	116, 705	73. 0	43, 164	27. 0	159, 869
1917	(a)	(a)	(a)	(a)	109, 989	71. 3	44, 185	28. 7	154, 174
1918	(a)	(a)	(a)	(a)	101, 671	69. 1	45, 450	30. 9	147, 121
1919	(a)	(a)	(a)	(a)	107, 829	69. 8	46, 742	30. 2	154, 571
1920	63, 339	43. 6	37, 684	26. 1	101, 023	69. 7	44, 051	30. 3	145, 074
1921	73, 977	46. 4	42, 840	26. 8	116, 817	73. 2	42, 682	26. 8	159, 499
1922	72, 527	46. 2	41, 752	26. 6	114, 279	72. 8	42, 570	27. 2	156, 849
1923	72, 362	45. 9	42, 359	26. 8	114, 721	72. 7	43, 022	27. 3	157, 743
1924	76, 035	47. 5	43, 328	27. 1	119, 363	74. 6	40, 646	25. 4	160, 009
Bituminous:									
1911	(a)	(a)	(a)	(a)	[b] 479, 294	86. 5	[b] 75, 114	13. 5	[b] 554, 408
1912	(a)	(a)	(a)	(a)	[c] 474, 513	86. 5	[c] 74, 119	13. 5	548, 632
1913	(a)	(a)	(a)	(a)	[c] 494, 238	86. 4	[c] 77, 644	13. 6	571, 882
1914	(a)	(a)	(a)	(a)	506, 025	86. 7	77, 481	13. 3	583, 506
1915	(a)	(a)	(a)	(a)	482, 433	86. 5	75, 023	13. 5	557, 456
1916	(a)	(a)	(a)	(a)	474, 244	84. 5	86, 858	15. 5	561, 102
1917	(a)	(a)	(a)	(a)	498, 185	82. 6	104, 958	17. 4	603, 143
1918	(a)	(a)	(a)	(a)	496, 252	80. 7	119, 053	19. 3	615, 305
1919	(a)	(a)	(a)	(a)	508, 801	81. 8	113, 197	18. 2	621, 998
1920	355, 660	55. 5	174, 152	27. 3	529, 812	82. 8	109, 735	17. 2	639, 547
1921	399, 270	60. 1	168, 019	25. 4	567, 289	85. 5	96, 465	14. 5	663, 754
1922	407, 772	59. 3	174, 637	25. 3	582, 409	84. 6	105, 549	15. 4	687, 958
1923	422, 040	59. 9	178, 265	25. 3	600, 305	85. 2	104, 488	14. 8	704, 793
1924	380, 324	61. 4	151, 580	24. 4	531, 904	85. 8	87, 700	14. 2	619, 604

[a] No data.

[b] In 1911 the Bureau of Mines made a special inquiry in connection with its accident statistics, the results of which are here shown. The totals obtained by the U. S. Geological Survey in that same year were 172,585 for anthracite and 549,775 for bituminous coal mines.

[c] Estimated by the Bureau of Mines.

TABLE 26.—*Men employed in coal mines, by States, 1923 and 1924*

1923

State	Underground				Surface		Total
	Miners, loaders, etc.[a]		All others				
	Number	Percentage	Number	Percentage	Number	Percentage	
Alabama	17,304	57.6	7,330	24.4	5,401	18.0	30,035
Alaska	73	36.7	48	24.1	78	39.2	199
Arkansas	2,124	56.6	846	22.6	784	20.8	3,754
California, Idaho, and Oregon	43	46.3	26	27.9	24	25.8	93
Colorado	8,064	60.5	3,114	23.3	2,162	16.2	13,340
Georgia	69	41.3	23	13.8	75	44.9	167
Illinois	64,194	64.3	24,900	25.0	10,620	10.7	99,714
Indiana	22,777	64.3	8,228	23.2	4,403	12.5	35,408
Iowa	7,797	68.1	2,709	23.7	942	8.2	11,448
Kansas	6,966	71.4	1,662	17.0	1,133	11.6	9,761
Kentucky	33,911	55.8	16,546	27.2	10,354	17.0	60,811
Maryland	2,360	63.4	814	21.8	551	14.8	3,725
Michigan	1,213	61.4	580	29.3	184	9.3	1,977
Missouri	4,217	60.7	1,335	19.2	1,400	20.1	6,952
Montana	2,054	58.5	910	25.9	547	15.6	3,511
New Mexico	2,522	61.6	1,025	25.0	548	13.4	4,095
North Carolina	55	36.7	70	46.7	25	16.6	150
North Dakota	883	54.5	257	15.8	481	29.7	1,621
Ohio	34,121	62.5	12,225	22.4	8,209	15.1	54,555
Oklahoma	4,100	57.5	1,930	27.1	1,100	15.4	7,130
Pennsylvania (bituminous)	120,385	61.7	46,183	23.7	28,413	14.6	194,981
South Dakota	34	100.0					34
Tennessee	6,752	60.0	2,733	24.3	1,759	15.7	11,244
Texas	1,641	66.9	493	20.1	318	13.0	2,452
Utah	2,379	54.3	1,063	24.3	939	21.4	4,381
Virginia	6,810	48.2	4,841	34.3	2,469	17.5	14,120
Washington	2,313	53.7	1,147	26.6	846	19.7	4,306
West Virginia	62,676	53.4	35,207	30.0	19,417	16.6	117,300
Wyoming	4,203	55.9	2,020	26.8	1,306	17.3	7,529
Total bituminous	422,040	59.9	178,265	25.3	104,488	14.8	704,793
Pennsylvania anthracite	72,362	45.9	42,359	26.8	43,022	27.3	157,743
Grand total	494,402	57.3	220,624	25.6	147,510	17.1	862,536

1924

State	Underground				Surface		Total
	Miners, loaders, etc.[a]		All others				
	Number	Percentage	Number	Percentage	Number	Percentage	
Alabama	15,892	56.8	7,216	25.8	4,848	17.4	27,956
Alaska	60	35.9	40	24.0	67	40.1	167
Arkansas	1,811	54.0	732	21.9	807	24.1	3,350
California, Idaho, Nebraska, and Oregon	36	43.4	20	24.1	27	32.5	83
Colorado	8,023	61.9	2,978	23.0	1,953	15.1	12,954
Georgia	55	38.5	19	13.3	69	48.2	143
Illinois	59,451	66.5	21,306	23.9	8,606	9.6	89,363
Indiana	17,717	64.3	6,210	22.5	3,631	13.2	27,558
Iowa	8,382	69.3	2,677	22.1	1,042	8.6	12,101
Kansas	6,182	72.2	1,250	14.6	1,129	13.2	8,561
Kentucky	31,864	57.1	14,703	26.4	9,199	16.5	55,766
Maryland	2,373	62.8	856	22.7	547	14.5	3,776
Michigan	1,016	65.5	390	25.1	145	9.4	1,551
Missouri	3,649	61.0	1,068	17.9	1,260	21.1	5,977
Montana	1,852	57.9	823	25.8	521	16.3	3,196
New Mexico	2,416	57.5	851	20.2	939	22.3	4,206
North Carolina	60	50.0	33	27.5	27	22.5	120
North Dakota	671	51.7	186	14.3	441	34.0	1,298
Ohio	29,481	66.7	8,966	20.3	5,782	13.0	44,229
Oklahoma	3,324	54.1	1,740	28.3	1,080	17.6	6,144
Pennsylvania (bituminous)	108,773	64.2	38,312	22.6	22,237	13.2	169,322
South Dakota	40	100.0					40
Tennessee	5,726	61.1	2,236	23.9	1,403	15.0	9,365
Texas	1,426	65.0	456	20.8	313	14.2	2,195
Utah	2,369	54.7	1,023	23.6	938	21.7	4,330
Virginia	6,131	48.4	4,255	33.6	2,293	18.0	12,679
Washington	2,192	56.8	982	25.5	684	17.7	3,858
West Virginia	55,067	53.9	30,480	29.8	16,656	16.3	102,203
Wyoming	4,285	60.3	1,772	24.9	1,056	14.8	7,113
Total bituminous	380,324	61.4	151,580	24.5	87,700	14.1	619,604
Pennsylvania anthracite	76,035	47.5	43,328	27.1	40,646	25.4	160,009
Grand total	456,359	58.5	194,908	25.0	128,346	16.5	779,613

[a] Also includes shot firers.

DAYS WORKED BY MINES

TABLE 27.—*Average number of days worked by coal mines, by States, 1913–1924*

State	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924
Alabama	255	226	223	262	273	278	239	247	166	215	232	220
Alaska	([a])	([a])	([a])	179	([a])	254	280	240	244	147	220	287
Arkansas	174	143	149	184	187	204	136	176	112	81	97	134
California[a]	302	291	285	188	173	240	59	181	149	250	206	156
Colorado	229	244	194	233	263	255	225	255	164	191	174	178
Georgia	261	207	197	280	269	258	284	294	183	242	231	248
Idaho	[b] 183	([a])	([a])	([a])	([a])	([a])	([a])	([a])	([a])	([a])	([a])	([a])
Illinois	189	173	179	198	243	238	160	213	152	120	158	148
Indiana	190	168	179	187	221	227	148	192	128	110	136	136
Iowa	195	204	220	202	251	245	176	250	148	131	181	161
Kansas	197	192	184	204	216	234	182	204	137	125	139	151
Kentucky	212	187	186	208	214	230	189	182	152	140	152	174
Maryland	248	241	242	256	254	261	179	207	129	101	178	173
Michigan	188	201	198	216	254	237	179	261	196	162	222	178
Missouri	187	179	186	207	240	235	175	233	166	113	155	135
Montana	228	209	201	244	268	264	194	250	143	140	179	173
New Mexico	289	283	262	292	321	301	273	302	150	216	216	204
North Carolina	------	------	------	------	------	40	100	288	300	167	275	287
North Dakota	221	216	219	244	255	229	216	218	194	175	182	165
Ohio	206	108	142	197	210	223	164	188	134	100	150	143
Oklahoma	197	205	167	178	211	228	184	217	141	114	133	124
Oregon	283	266	206	236	251	292	259	307	([a])	([a])	([a])	([a])
Pennsylvania (bituminous)	267	214	226	259	261	269	218	244	151	154	213	180
South Dakota	137	152	155	145	154	145	164	133	129	138	122	138
Tennessee	241	220	220	239	241	265	201	234	154	163	183	159
Texas	253	237	233	218	263	262	227	242	139	185	178	166
Utah	273	210	208	228	219	258	239	252	151	204	160	182
Virginia	280	235	235	272	273	277	247	262	166	198	212	226
Washington	260	191	169	217	271	275	217	260	159	194	213	202
West Virginia	234	201	208	237	225	238	200	198	149	143	169	182
Wyoming	232	192	201	248	246	268	221	264	167	128	192	176
Total bituminous	232	195	203	230	243	249	195	220	149	142	179	171
Pennsylvania anthracite	257	245	230	253	285	293	266	271	271	151	268	274
Grand total	238	207	209	235	251	258	209	230	173	144	195	192

[a] California includes Alaska in 1913; Idaho and Nevada, 1914 and 1915; Idaho, 1916–1920; Idaho and Oregon, 1921–1923; and Idaho, Nebraska, and Oregon in 1924. The number of days was not reported for Alaska in 1914, 1915, and 1917.

[b] Includes Nevada.

TABLE 28.—*Days worked and lost at bituminous coal mines, 1880, 1920, 1923, and 1924*

	1880 [a]	1920	1923	1924
Days worked	233	220	179	171
Days lost, total	75	88	129	137
Days lost account strikes	21	6	2	7
Days lost, other causes	54	82	127	130
Total days	308	308	308	308

[a] From data in Tenth Census, vol. 15, Mining Industries, p. 683. As originally published the data were expressed as per cent of the working year.

LENGTH OF WORKING DAY

TABLE 29.—*Number of bituminous coal mines having established working days of certain length and number of men employed in 1923–24*

[Wagon mines not included]

State	8 hours		9 hours		10 hours		All others and not reporting[a]		Total	
	Mines	Men	Mines	Men	Mines	Men	Mines	Men	Mines	Men
1923										
Alabama	143	12,989	74	12,478	21	3,061	50	1,507	288	30,035
Alaska	8	181	------	------	------	------	4	18	12	199
Arkansas	87	3,551	1	40	3	153	3	10	94	3,754
California, Idaho, and Oregon	5	[b]93	------	------	------	------	------	------	5	93
Colorado	169	[b]12,934	2	175	------	------	65	231	236	13,340
Georgia	1	147	------	------	------	------	2	20	3	167
Illinois	455	98,809	------	------	1	16	119	889	575	99,714
Indiana	264	35,116	1	2	------	------	36	290	301	35,408
Iowa	131	11,353	------	------	------	------	20	95	151	11,448
Kansas	209	9,697	1	5	------	------	12	59	222	9,761
Kentucky	666	53,428	65	5,239	18	855	86	1,289	835	60,811
Maryland	94	3,646	------	------	1	26	10	53	105	3,725
Michigan	12	1,939	------	------	------	------	1	38	13	1,977
Missouri	129	6,744	2	61	------	------	18	147	149	6,952
Montana	32	3,445	------	------	------	------	16	66	48	3,511
New Mexico	35	[b]4,072	------	------	------	------	7	23	42	4,095
North Carolina	2	150	------	------	------	------	------	------	2	150
North Dakota	52	1,218	3	40	3	92	64	271	122	1,621
Ohio	773	[b]53,555	6	120	8	372	119	508	906	54,555
Oklahoma	107	6,873	4	183	2	70	2	4	115	7,130
Pennsylvania (bituminous)	2,463	187,681	95	4,881	11	368	299	2,051	2,868	194,981
South Dakota	------	------	------	------	------	------	15	34	15	34
Tennessee	175	10,624	------	------	5	[c]548	11	72	191	11,244
Texas	15	885	17	695	5	454	7	418	44	2,452
Utah	35	4,375	------	------	------	------	2	6	37	4,381
Virginia	140	[b]12,883	5	229	5	869	18	139	168	14,120
Washington	54	4,298	------	------	------	------	2	8	56	4,306
West Virginia	1,542	[b]110,599	48	4,972	17	1,146	59	583	1,666	117,300
Wyoming	61	7,524	------	------	------	------	1	5	62	7,529
	7,859	658,809	324	29,120	100	8,030	1,048	8,834	9,331	704,793
1924										
Alabama	112	[b]9,209	83	14,390	28	4,017	15	340	238	27,956
Alaska	6	163	------	------	------	------	2	4	8	167
Arkansas	79	3,107	2	62	2	120	3	61	86	3,350
California, Idaho, Nebraska, and Oregon	4	60	------	------	------	------	5	23	9	83
Colorado	159	[b]12,434	3	290	------	------	69	230	231	12,954
Georgia	2	143	------	------	------	------	------	------	2	143
Illinois	396	88,950	2	13	------	------	90	400	488	89,363
Indiana	213	27,347	2	42	------	------	33	169	248	27,558
Iowa	179	11,617	1	6	------	------	76	478	256	12,101
Kansas	174	8,297	------	------	------	------	54	264	228	8,561
Kentucky	543	[b]49,022	50	5,372	21	963	46	409	660	55,766
Maryland	74	3,599	1	27	------	------	18	150	93	3,776
Michigan	9	1,551	------	------	------	------	------	------	9	1,551
Missouri	111	[b]5,802	2	97	1	10	13	68	127	5,977
Montana	33	3,006	------	------	1	38	34	152	68	3,196
New Mexico	35	[b]4,185	------	------	------	------	7	21	42	4,206
North Carolina	2	120	------	------	------	------	------	------	2	120
North Dakota	48	848	2	23	6	142	76	285	132	1,298
Ohio	572	43,010	12	131	8	522	158	566	750	44,229
Oklahoma	84	5,804	4	212	2	87	4	41	94	6,144
Pennsylvania (bituminous)	1,862	[b]163,162	78	4,836	11	404	171	920	2,122	169,322
South Dakota	------	------	------	------	------	------	16	40	16	40
Tennessee	133	8,860	2	465	------	------	4	40	139	9,365
Texas	26	1,073	8	421	2	39	8	662	44	2,195
Utah	37	4,318	------	------	------	------	2	12	39	4,330
Virginia	105	[b]12,431	3	121	3	113	4	14	115	12,679
Washington	55	3,841	------	------	------	------	3	17	58	3,858
West Virginia	1,136	95,996	37	4,734	13	995	34	478	1,220	102,203
Wyoming	61	[b]7,073	------	------	------	------	1	40	62	7,113
	6,250	575,028	292	31,242	98	7,450	946	5,884	7,586	619,604

[a] Includes employees in mines where the established working day was changed during the year, or where the working day was irregular, or which failed to answer inquiry.

[b] Includes outside employees working 9 hours or 10 hours a day at certain mines where the established time for underground workers is 8 hours.

[c] Worked 9 hours first of year and 10 hours last of year.

TABLE 30.—*Percentage of men employed in bituminous coal mines that had established working days of 8, 9, and 10 hours, 1903–1924* [a]

Year	Per cent of total employees in—			Weighted average working day (hours)	Year	Per cent of total employees in—			Weighted average working day (hours)
	8-hour mines	9-hour mines	10-hour mines			8-hour mines	9-hour mines	10-hour mines	
1903	56.4	17.1	26.5	8.7	1915	59.6	17.0	23.4	8.6
1904	62.1	13.8	24.1	8.6	1916	58.6	17.4	24.0	8.6
1905	61.1	13.6	25.3	8.6	1917	79.0	12.6	8.4	8.3
1906	63.0	13.5	23.5	8.6	1918	90.6	6.7	2.7	8.12
1907	64.0	11.6	24.4	8.6	1919	95.5	3.5	1.0	8.06
1908	63.5	11.1	25.4	8.6	1920	97.1	2.0	.9	8.04
1910	62.1	11.3	26.6	8.6	1921	96.6	2.9	.5	8.04
1911	62.9	10.9	26.2	8.6	1922	95.1	4.0	.9	8.06
1912	61.6	11.5	26.9	8.6	1923	94.7	4.2	1.1	8.06
1913	61.9	15.2	22.9	8.6	1924	93.7	5.1	1.2	8.08
1914	60.7	15.4	23.9	8.6					

[a] Percentages are calculated on base of total number of men in mines definitely reported as having 8-hour, 9-hour, or 10-hour day. A small number of mines that work more than 10 hours or less than 8 hours have been excluded, as have also all mines for which the reports were defective or which changed their working day during the year.

OUTPUT PER MAN

TABLE 31.—*Coal produced per man and average number of days worked per year, by States, 1922–1924*

State	1922			1923			1924		
	Days mines worked	Average tonnage per man		Days mines worked	Average tonnage per man		Days mines worked	Average tonnage per man	
		Per year	Per day		Per year	Per day		Per year	Per day
Alabama	215	647	3.01	232	680	2.93	220	684	3.11
Arkansas	81	269	3.32	97	329	3.39	134	433	3.24
Colorado	191	740	3.87	174	774	[a] 4.45	178	806	[a] 4.52
Illinois	120	606	5.05	158	795	5.02	148	765	5.16
Indiana	110	571	5.19	136	738	5.43	136	779	5.75
Iowa	131	334	2.55	181	498	2.75	161	452	2.80
Kansas	125	377	3.02	139	443	3.19	151	496	3.29
Kentucky	140	684	4.89	152	735	4.83	174	810	4.67
Maryland	101	318	3.15	178	608	3.42	173	565	3.27
Michigan	162	429	2.65	222	593	2.67	178	536	3.00
Missouri	113	326	2.88	155	477	3.07	135	415	3.08
Montana	140	704	5.03	179	896	5.00	173	909	5.26
New Mexico	216	779	3.61	216	708	3.28	204	662	3.25
North Dakota	175	769	4.39	182	837	4.60	165	925	5.62
Ohio	100	492	4.92	150	742	4.95	143	689	4.82
Oklahoma	114	356	3.12	133	398	2.99	124	379	3.05
Pennsylvania (bituminous)	154	592	3.84	213	882	4.15	180	772	4.27
Tennessee	163	422	2.59	183	536	2.93	159	487	3.05
Texas	185	389	2.10	178	484	2.72	166	523	3.16
Utah	204	1,057	[a] 5.18	160	1,077	[a] 6.73	182	1,037	[a] 5.70
Virginia	198	779	3.93	212	832	3.92	226	843	3.73
Washington	194	575	2.96	213	680	3.19	202	688	3.41
West Virginia	143	729	5.10	169	919	5.44	182	995	5.48
Wyoming	128	659	5.15	192	1,004	5.23	176	950	5.41
Total bituminous	142	609	4.28	179	801	4.47	171	781	4.56
Pennsylvania anthracite	151	349	2.31	268	592	2.21	274	550	2.00
Grand total	148	565	3.89	195	763	3.91	192	733	3.81

[a] Probably too high because of practice common in some districts of men going into mine to shoot coal and load mine cars on days when tipples or mines as a whole are not in operation.

TABLE 32.—*Coal produced per man employed, 1890–1924, in net tons*

Year	Anthracite				Bituminous			
	Men employed	Days worked	Average tonnage		Men employed	Days worked	Average tonnage	
			Per day	Per year			Per day	Per year
1890	126,000	200	1.85	369	192,204	226	2.56	579
1891	126,350	203	1.98	401	205,803	223	2.57	573
1892	129,050	198	2.06	407	212,893	219	2.72	596
1893	132,944	197	2.06	406	230,365	204	2.73	557
1894	131,603	190	2.08	395	244,603	171	2.84	486
1895	142,917	196	2.07	406	239,962	194	2.90	563
1896	148,991	174	2.10	365	244,171	192	2.94	564
1897	149,884	150	2.34	351	247,817	196	3.04	596
1898	145,504	152	2.41	367	255,717	211	3.09	651
1899	139,608	173	2.50	433	271,027	234	3.05	713
1900	144,206	166	2.40	398	304,375	234	2.98	697
1901	145,309	196	2.37	464	340,235	225	2.94	664
1902	148,141	116	2.40	279	370,056	230	3.06	703
1903	150,483	206	2.41	496	415,777	225	3.02	680
1904	155,861	200	2.35	469	437,832	202	3.15	637
1905	165,406	215	2.18	470	460,629	211	3.24	684
1906	162,355	195	2.25	439	478,425	213	3.36	717
1907	167,234	220	2.33	512	513,258	234	3.29	769
1908	174,174	200	2.39	478	516,264	193	3.34	644
1909 [a]	[b] 173,504	[c] 205	([d])	([d])	[b] 543,152	[c] 209	([d])	([d])
1910	169,497	229	2.17	498	555,533	217	3.46	751
1911	172,585	246	2.13	524	549,775	211	3.50	738
1912	174,030	231	2.10	485	548,632	223	3.68	820
1913	175,745	257	2.02	520	571,882	232	3.61	837
1914	179,679	245	2.06	505	583,506	195	3.71	724
1915	176,552	230	2.19	504	557,456	203	3.91	794
1916	159,869	253	2.16	548	561,102	230	3.90	896
1917	154,174	285	[e] 2.27	[e] 646	603,143	243	3.77	915
1918	147,121	293	[e] 2.29	[e] 672	615,305	249	3.78	942
1919	154,571	266	2.14	570	621,998	195	3.84	749
1920	145,074	271	[e] 2.28	[e] 618	639,547	220	4.00	881
1921	159,499	271	2.09	567	663,754	149	4.20	627
1922	156,849	151	[e] 2.31	[e] 349	687,958	142	4.28	609
1923	157,743	268	2.21	592	704,793	179	4.47	801
1924	160,009	274	2.00	550	619,604	171	4.56	781

[a] No reports of number of employees and days worked were collected by the Geological Survey in 1909.

[b] Number of wage earners on Dec. 15 as reported by census of mines and quarries for 1909. The figures for bituminous coal exclude coke workers.

[c] Estimated.

[d] Comparable data not available.

[e] Heavy washery product.

TABLE 33.—*Bituminous coal produced per man per day in the seven States of largest production and in the United States, 1900–1908, 910–1924, in net tons*

Year	Total United States	Ohio	Indiana	Illinois	Pennsylvania	Colorado	West Virginia	Kentucky
1900	2.98	3.20	2.78	2.92	3.56	2.66	3.36	2.43
1901	2.94	3.29	2.75	2.97	3.53	2.54	3.55	2.49
1902	3.06	3.02	2.98	3.08	3.52	3.16	3.38	2.35
1903	3.02	3.05	3.22	3.21	3.40	3.28	3.36	2.54
1904	3.15	3.20	3.14	3.13	3.70	3.14	3.49	2.71
1905	3.24	3.35	3.11	3.29	3.57	3.14	3.74	2.87
1906	3.36	3.65	3.30	3.49	3.68	3.32	3.86	2.98
1907	3.29	3.45	3.38	3.59	3.61	2.94	3.54	3.02
1908	3.34	3.44	3.85	3.79	3.51	3.13	3.98	3.24
1910	3.46	3.61	3.67	3.95	3.61	3.20	3.94	3.26
1911	3.50	3.73	3.68	3.73	3.69	3.42	4.05	3.18
1912	3.68	3.77	3.88	3.95	3.89	3.72	4.31	3.38
1913	3.61	3.83	4.06	4.10	3.78	3.36	4.07	3.51
1914	3.71	3.84	4.27	4.18	3.75	3.32	4.52	3.79
1915	3.91	3.94	4.17	4.35	4.00	3.60	4.89	4.11
1916	3.90	4.26	4.48	4.42	3.91	3.43	[a] 4.68	[a] 3.91
1917	[a] 3.77	4.26	4.52	4.22	3.80	3.33	[a] 4.35	[a] 3.72
1918	[a] 3.78	4.24	4.45	4.37	3.81	3.36	[a] 4.22	[a] 3.50
1919	[a] 3.84	4.41	4.72	4.48	3.96	3.88	[a] 4.18	[a] 3.49
1920	4.00	4.73	4.36	4.78	3.96	3.51	4.39	3.95
1921	4.20	4.60	4.86	4.80	4.03	3.83	4.79	4.11
1922	4.28	4.92	5.19	5.05	[b] 3.84	3.87	5.10	4.89
1923	4.47	4.95	5.43	5.02	4.15	4.45	5.44	4.83
1924	4.56	4.82	5.75	5.16	4.27	4.52	5.48	4.67

[a] Apparent decrease largely explained by adoption of the 8-hour day in certain nonunion fields.

[b] Affected by strike.

TABLE 34.—*Coal produced from deep mines per man employed underground per day worked, 1911–1924, in net tons* [a]

Year	Anthracite	Bituminous	Year	Anthracite	Bituminous
1911	2.75	4.01	1918	2.94	4.62
1912	2.69	4.24	1919	2.81	4.64
1913	2.67	4.16	1920	2.93	4.80
1914	2.67	4.28	1921	2.70	4.86
1915	2.78	4.49	1922	2.87	4.98
1916	2.74	4.57	1923	[b] 2.70	5.15
1917	2.89	4.51	1924	[b] 2.53	5.17

[a] In making this computation certain estimates had to be made of the division of workers above and below ground and of the production of strip pits in the years 1911 to 1913. The probable error introduced by these estimates is too small to impair the value of the averages.

[b] Beginning with 1923, a small tonnage of culm-bank coal handled through breakers and hitherto counted as fresh-mined coal has been excluded, and the figures are therefore not exactly comparable with earlier years. The difference, however, is small. (See p. 567.)

STRIKES AND LOCKOUTS

TABLE 35.—*Summary of strikes and lockouts in coal mines, 1899–1924*

Year	Number of men on strike	Total man-days idle	Average number of days lost per man striking	Year	Number of men on strike	Total man-days idle	Average number of days lost per man striking
1899	45, 981	2, 124, 154	46	1912	311, 056	12, 527, 305	40
1900	131, 973	4, 878, 102	37	1913	135, 395	3, 049, 412	22. 5
1901 [a]	20, 593	733, 802	35	1914	161, 720	11, 013, 667	68
1902	200, 452	16, 672, 217	83	1915	67, 190	2, 467, 431	37
1903 [a]	47, 481	1, 341, 031	28	1916	170, 633	3, 344, 586	20
1904	77, 661	3, 382, 830	44	1917	160, 240	2, 348, 399	15
1905	37, 542	796, 735	21	1918	79, 395	508, 526	6
1906	372, 343	19, 201, 348	51. 5	1919	453, 418	15, 761, 410	35
1907 [a]	32, 540	462, 392	14	1920	282, 419	5, 914, 473	21
1908 [a]	145, 145	5, 449, 938	38	1921	151, 263	3, 106, 103	21
1909	25, 534	731, 650	29	1922	603, 031	73, 497, 043	122
1910	218, 493	19, 250, 524	88	1923	197, 214	3, 868, 543	20
1911	41, 413	983, 737	24	1924	129, 452	5, 362, 748	41

[a] Bituminous coal mines only. No strikes of consequence occurred in the anthracite region in these years.

TABLE 36.—*Days lost at coal mines on account of strikes and lockouts compared with days lost for other causes, 1900–1924*

[Includes both anthracite and bituminous coal mines]

Year	Days lost		
	On account of strikes and lockouts	On account of no market, car shortage, and similar difficulties	Total
1900	4, 878, 102	38, 122, 900	43, 001, 002
1901 [a]	733, 802	43, 780, 311	44, 514, 113
1902	16, 672, 217	40, 635, 223	57, 307, 440
1903 [a]	1, 341, 031	48, 517, 726	49, 858, 757
1904	3, 382, 830	59, 860, 350	63, 243, 180
1905	796, 735	59, 267, 036	60, 063, 771
1906	19, 201, 348	44, 595, 142	63, 796, 490
1907 [a]	462, 392	52, 235, 292	52, 697, 684
1908 [a]	5, 449, 938	72, 731, 214	78, 181, 152
1909	731, 650	64, 332, 335	65, 063, 985
1910	19, 250, 524	44, 693, 242	63, 943, 766
1911	983, 737	63, 044, 708	64, 028, 445
1912	12, 527, 305	47, 506, 725	60, 034, 030
1913	3, 049, 412	49, 376, 615	52, 426, 027
1914	11, 013, 667	66, 242, 288	77, 255, 955
1915	2, 467, 431	69, 836, 505	72, 303, 936
1916	3, 344, 586	49, 214, 165	52, 558, 751
1917	2, 348, 399	40, 401, 898	42, 750, 297
1918	508, 526	38, 001, 284	38, 509, 810
1919	15, 761, 410	61, 023, 906	76, 785, 316
1920	5, 914, 473	55, 732, 698	61, 647, 171
1921	3, 106, 103	108, 332, 246	111, 438, 349
1922	73, 497, 043	65, 186, 691	138, 683, 734
1923	3, 868, 543	93, 359, 474	97, 228, 017
1924	5, 362, 748	84, 963, 306	90, 326, 054
Total, 25 years	216, 653, 952	1, 460, 993, 280	1, 677, 647, 232

[a] No serious strikes occurred in the anthracite region in these years.

TABLE 37.—*Strikes and lockouts in coal mines, by States, 1923 and 1924*

State	1923					1924				
	Total number of men employed	Number of men on strike	Man-days idle on account of strike	Average number of days lost on account of strike		Total number of men employed	Number of men on strike	Man-days idle on account of strike	Average number of days lost on account of strike	
				Per man employed	Per man on strike				Per man employed	Per man on strike
Alabama	30,035	------	------	------	------	27,956	------	------	------	------
Arkansas	3,754	324	9,009	2	28	3,350	1,076	29,272	9	27
Colorado	13,340	------	------	------	------	12,954	120	840	(a)	7
Illinois	99,714	7,474	95,458	1	13	89,363	4,217	50,101	1	12
Indiana	35,408	10,765	104,604	3	10	27,558	7,699	159,743	6	21
Iowa	11,448	1,946	19,874	2	10	12,101	986	16,445	1	17
Kansas	9,761	949	24,741	3	26	8,561	2,706	118,918	14	44
Kentucky	60,811	2,699	92,035	2	34	55,766	8,938	1,735,739	31	194
Maryland	3,725	2,686	359,920	97	134	3,776	168	504	(a)	3
Michigan	1,977	786	3,992	2	5	1,551	425	1,525	1	4
Missouri	6,952	312	10,857	2	35	5,977	1,580	76,660	13	49
Montana	3,511	25	25	(a)	(a)	3,196	17	53	(a)	3
New Mexico	4,095	------	------	------	------	4,206	------	------	------	------
North Dakota	1,621	85	6,933	4	82	1,298	------	------	------	------
Ohio	54,555	16,486	203,161	4	12	44,229	10,256	217,752	5	21
Oklahoma	7,130	1,020	8,211	1	8	6,144	1,318	144,607	24	110
Pennsylvania (bituminous)	194,981	10,984	157,130	1	14	169,322	8,793	361,226	2	41
Tennessee	11,244	572	24,766	2	43	9,365	2,134	244,945	26	115
Texas	2,452	137	18,141	7	132	2,195	------	------	------	------
Utah	4,381	------	------	------	------	4,330	58	310	(a)	5
Virginia	14,120	------	------	------	------	12,679	------	------	------	------
Washington	4,306	1,754	50,681	12	29	3,858	------	------	------	------
West Virginia	117,300	2,625	49,587	(a)	19	102,203	7,688	1,060,478	10	138
Wyoming	7,529	------	------	------	------	7,113	------	------	------	------
Other States	643	------	------	------	------	553	------	------	------	------
Total bituminous	704,793	61,629	1,239,125	2	20	619,604	58,179	4,219,118	7	73
Pennsylvania anthracite	157,743	135,585	2,629,418	17	19	160,009	71,273	1,143,630	7	16
Grand total	862,536	197,214	3,868,543	4	20	779,613	129,452	5,362,748	7	41

[a] Less than one-half day.

MINING METHODS

TABLE 38.—*Bituminous coal mined by different methods, by States, 1923 and 1924*

State	Mined by hand		Shot off the solid		Mined by machines		From strip pits		Not specified		Total production (net tons)
	Net tons	Percentage	Net tons	Percentage	Net tons	Percentage	Net tons	Percentage	Net tons	Percentage	
1923											
Alabama	3,740,428	18.3	7,241,565	35.4	8,716,291	42.6	545,102	2.7	214,263	1.0	20,457,649
Alaska	11,983	10.0	107,843	90.0	----------	----------	----------	----------	----------	----------	119,826
Arkansas	30,130	2.3	839,070	64.7	189,861	14.6	154,731	12.0	83,100	6.4	1,296,892
Colorado	4,430,770	42.8	894,033	8.7	4,896,915	47.3	----------	----------	124,500	1.2	10,346,218
Georgia	2,400	3.2	21,681	28.7	----------	----------	50,589	66.9	950	1.2	75,620
Illinois	4,618,236	5.8	18,936,803	23.9	54,170,999	68.3	1,283,044	1.6	300,993	.4	79,310,075
Indiana	1,017,529	3.9	8,278,979	31.6	14,234,398	54.3	2,289,887	8.7	408,306	1.5	26,229,099
Iowa	1,011,345	17.7	3,447,076	60.4	1,181,342	20.7	----------	----------	70,972	1.2	5,710,735
Kansas	104,164	2.3	3,445,664	77.6	97,941	2.2	651,155	14.7	144,225	3.2	4,443,149
Kentucky	1,569,655	3.5	4,143,137	9.3	37,710,934	84.2	844,003	1.9	509,588	1.1	44,777,317
Maryland	1,410,336	61.7	255,939	11.2	582,734	25.5	----------	----------	36,917	1.6	2,285,926
Michigan	----------	----------	81,238	6.9	1,086,337	92.7	----------	----------	4,500	.4	1,172,075
Missouri	481,472	14.1	955,100	28.1	1,005,756	29.6	845,143	24.8	115,680	3.4	3,403,151
Montana	785,925	25.0	842,054	26.7	1,495,902	47.5	----------	----------	23,797	.8	3,147,678
New Mexico	1,364,383	46.8	670,840	23.0	851,705	29.2	----------	----------	28,245	1.0	2,915,173
North Dakota	20,797	1.5	373,175	26.9	426,008	30.8	376,384	27.2	189,036	13.6	1,385,400
Ohio	650,361	1.6	654,651	1.6	35,877,385	88.5	2,988,819	7.4	375,227	.9	40,546,443
Oklahoma	58,176	2.0	816,556	28.3	1,636.668	56.7	313,471	10.9	60,167	2.1	2,885,038
Pennsylvania [a]	54,503,203	31.7	4,315,347	2.5	110,326,052	64.1	1,299,166	.8	1,436,145	.9	171,879,913
Tennessee	923,021	15.3	3,002,172	49.7	1,999,345	33.1	1,704	----------	114,026	1.9	6,040,268
Texas	690,535	58.1	371,222	31.3	44,519	3.8	----------	----------	81,053	6.8	1,187,329
Utah	1,175,487	24.9	322,905	6.8	3,221,425	68.3	----------	----------	400	----------	4,720,217
Virginia	511,564	4.4	2,520,870	21.4	8,645,351	73.5	----------	----------	83,858	.7	11,761,643
Washington	1,605,634	54.9	1,025,617	35.1	252,880	8.6	----------	----------	42,261	1.4	2,926,392
West Virginia	17,895,509	16.6	4,179,989	3.9	84,986,380	78.7	296,936	.3	541,127	.5	107,899,941
Wyoming	1,001,323	13.2	2,764,456	36.5	3,793,415	50.1	----------	----------	15,837	.2	7,575,031
Other States	23,769	35.7	27,306	41.1	5,000	7.6	----------	----------	10,389	15.6	66,464
	99,638,135	17.6	70,535,288	12.5	377,435,543	66.9	11,940,134	2.1	5,015,562	.9	564,564,662
1924											
Alabama	3,004,923	15.7	6,004,886	31.4	9,704,205	50.7	370,081	1.9	46,089	.3	19,130,184
Alaska	9,966	10.0	89,697	90.0	----------	----------	----------	----------	----------	----------	99,663
Arkansas	21,732	1.5	848,616	58.5	357,648	24.6	223,307	15.4	200	----------	1,451,503
Colorado	4,053,426	38.8	933,651	9.0	5,327,817	51.0	----------	----------	129,204	1.2	10,444,098
Georgia	----------	----------	9,290	12.4	----------	----------	65,657	87.6	----------	----------	74,947
Illinois	2,276,118	3.3	14,615,745	21.4	48,915,060	71.6	2,295,860	3.4	220,498	.3	68,323,281
Indiana	687,524	3.2	5,342,727	24.9	12,845,838	59.8	2,511,189	11.7	92,935	.4	21,480,213

Iowa	999, 524	18. 3	3, 269, 790	59. 8	1, 011, 472	18. 5	400		187, 264	3. 4	5, 468, 450
Kansas	273, 652	6. 5	3, 020, 460	71. 1	97, 727	2. 3	795, 074	18. 7	60, 820	1. 4	4, 247, 733
Kentucky	1, 600, 472	3. 5	2, 808, 298	6. 2	39, 359, 428	87. 2	1, 300, 855	2. 9	78, 151	. 2	45, 147, 204
Maryland	1, 553, 559	72. 8	35, 745	1. 7	543, 509	25. 5			890		2, 133, 703
Michigan			39, 687	4. 8	791, 333	95. 2					831, 020
Missouri	384, 108	15. 5	357, 955	14. 4	730, 280	29. 4	979, 700	39. 5	28, 837	1. 2	2, 480, 880
Montana	572, 469	19. 7	622, 306	21. 4	1, 499, 572	51. 6	193, 372	6. 7	17, 646	. 6	2, 905, 365
New Mexico	935, 493	33. 6	872, 136	31. 3	967, 343	34. 7			11, 091	. 4	2, 786, 063
North Carolina	29, 094	51. 0	28, 000	49. 0							57, 094
North Dakota	40, 196	3. 3	275, 802	23. 0	375, 702	31. 3	434, 184	36. 2	74, 643	6. 2	1, 200, 527
Ohio	549, 751	1. 8	431, 526	1. 4	26, 321, 897	86. 4	2, 866, 683	9. 4	303, 150	1. 0	30, 473, 007
Oklahoma	13, 808	. 6	643, 339	27. 6	1, 359, 959	58. 4	312, 109	13. 4	400		2, 329. 615
Pennsylvania [a]	41, 253, 204	31. 6	3, 150, 343	2. 4	84, 608, 265	64. 8	902, 818	. 7	719, 143	. 5	130, 633, 773
South Dakota									12, 043	100. 0	12, 043
Tennessee	594, 451	13. 1	1, 851, 315	40. 6	2, 092, 453	45. 9			18, 336	. 4	4, 556, 555
Texas	594, 011	51. 8	334, 049	29. 1	107, 834	9. 4	111, 117	9. 7			1, 147, 011
Utah	730, 401	16. 3	399, 194	8. 9	3, 358, 474	74. 8			88		4, 488, 157
Virginia	224, 245	2. 1	1, 923, 891	18. 0	8, 518, 845	79. 7			26, 483	. 2	10, 693, 464
Washington	1, 404, 523	52. 9	972, 129	36. 7	277, 015	10. 4					2, 653, 667
West Virginia	16, 123, 438	15. 9	1, 863, 700	1. 8	83, 373, 480	82. 0	244, 448	. 2	57, 831	. 1	101, 662, 897
Wyoming	737, 107	10. 9	2, 300, 932	34. 0	3, 719, 429	55. 1					6, 757, 468
Other States	4, 000	23. 6	4, 878	28. 8	6, 750	39. 8	100	. 6	1, 225	7. 2	16, 953
	78, 671, 195	16. 3	53, 050, 087	11. 0	336, 271, 335	69. 5	13, 606, 954	2. 8	2, 086, 967	. 4	483, 686, 538

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[a] Bituminous coal only.

TABLE 39.—*Number of coal-cutting machines in bituminous coal mines, average output per machine, and per cent of total product mined by machines, by States, 1913 and 1922–1924*

State	Number of coal-cutting machines in use				Average output per machine				Percentage of total product cut by machines			
	1913	1922	1923	1924	1913	1922	1923	1924	1913	1922	1923	1924
Alabama	377	355	395	426	10, 940	20, 466	22, 067	22, 780	23. 3	39. 7	42. 6	50. 7
Arkansas	27	45	40	59	9, 300	3, 809	4, 769	6, 062	11. 2	15. 5	14. 6	24. 6
Colorado	300	455	440	404	7, 705	11, 102	11, 129	13, 188	25. 0	50. 4	47. 3	51. 0
Illinois	1, 845	2, 841	3, 151	2, 923	17, 686	13, 710	17, 191	16, 735	53. 0	66. 1	68. 3	71. 6
Indiana	732	797	852	760	13, 302	11, 969	16, 107	16, 902	56. 7	49. 8	54. 3	59. 8
Iowa	28	91	81	68	4, 311	6, 471	14, 584	14, 875	1. 6	13. 6	20. 7	18. 5
Kansas	9	17	22	26	2, 458	5, 597	4, 452	3, 759	. 3	3. 2	2. 2	2. 3
Kentucky	1, 263	1, 784	1, 928	1, 910	11, 365	18, 678	19, 559	20, 607	73. 2	71. 1	84. 2	87. 2
Maryland	13	31	47	43	6, 384	9, 776	12, 398	12, 640	1. 7	14. 8	25. 5	25. 5
Michigan	130	88	80	64	6, 636	10, 152	13, 579	12, 365	70. 0	96. 1	92. 7	95. 2
Missouri	104	132	135	113	8, 307	6, 602	7, 450	6, 463	20. 0	29. 8	29. 6	29. 4
Montana	97	84	95	94	11, 099	17, 067	15, 746	15, 953	33. 2	55. 8	47. 5	51. 6
New Mexico	44	107	107	109	11, 297	9, 219	7, 960	8, 875	13. 4	31. 3	29. 2	34. 7
North Carolina	------	1	1	------	------	28, 300	5, 000	------	------	14. 8	13. 9	------
North Dakota	13	20	25	23	17, 094	22, 122	17, 040	16, 335	44. 9	33. 3	30. 8	31. 3
Ohio	1, 681	2, 342	2, 351	1, 906	19, 418	9, 258	15, 260	13, 810	90. 2	80. 5	88. 5	86. 4
Oklahoma	103	207	183	187	6, 511	6, 756	8, 943	7, 273	16. 1	49. 9	56. 7	58. 4
Pennsylvania	6, 301	6, 337	6, 481	5, 377	14, 678	10, 355	17, 020	15, 735	58. 2	58. 0	64. 1	64. 8
Tennessee	252	180	171	146	7, 312	1, 975	11, 692	14, 332	26. 7	29. 5	33. 1	45. 9
Texas	24	4	5	8	4, 204	11, 804	8, 904	13, 479	4. 2	4. 3	3. 8	9. 4
Utah	50	183	192	191	12, 510	20, 855	16, 778	17, 492	19. 2	76. 5	68. 3	74. 8
Virginia	187	264	277	282	22, 497	28, 566	31, 210	29, 174	47. 6	71. 9	73. 5	79. 7
Washington	63	27	26	20	4, 453	12, 227	9, 726	13, 851	7. 2	12. 8	8. 6	10. 4
West Virginia	2, 539	3, 809	3, 936	3, 312	15, 500	16, 214	21, 592	25, 173	55. 3	76. 7	78. 7	82. 0
Wyoming	195	235	208	208	15, 645	14, 689	18, 237	17, 882	41. 3	57. 8	50. 1	55. 1
Other States	2	------	------	1	600	------	------	6, 750	4. 8	------	------	39. 8
	16, 379	20, 436	21, 229	18, 660	14, 801	13, 067	17, 779	18, 021	50. 7	63. 2	66. 9	69. 5

TABLE 40.—*Bituminous coal mined by undercutting machines, 1891–1924*

Year	Machines in use	Quantity mined by undercutting machine (net tons)		Year	Machines in use	Quantity mined by undercutting machine (net tons)	
		Total	Average per machine			Total	Average per machine
1891	545	6, 211, 732	11, 398	1910	13, 254	174, 012, 293	13, 127
1896	1, 446	16, 424, 932	11, 373	1911	13, 829	178, 158, 236	12, 854
1897	1, 956	22, 649, 220	11, 579	1912	15, 298	210, 538, 822	13, 763
1898	2, 622	32, 413, 144	12, 362	1913	16, 379	242, 421, 713	14, 801
1899	3, 125	43, 963, 933	14, 068	1914	16, 507	218, 399, 287	13, 231
1900	3, 907	52, 784, 523	13, 510	1915	15, 692	243, 237, 551	15, 501
1901	4, 341	57, 843, 335	13, 325	1916	16, 198	283, 691, 475	17, 514
1902	5, 418	69, 611, 582	12, 848	1917	17, 235	306, 396, 127	17, 777
1903	6, 658	77, 974, 894	11, 712	1918	18, 463	323, 931, 133	17, 545
1904	7, 663	78, 606, 907	10, 258	1919	18, 959	276, 019, 799	14, 559
1905	9. 184	103, 396, 452	11, 258	1920	19, 103	339, 813, 476	17, 788
1906	10, 212	118, 847, 527	11, 638	1921	19, 618	272, 702, 389	13, 901
1907	11, 144	138, 547, 823	12, 432	1922	20, 436	267, 032, 931	13, 067
1908	11, 569	123, 183, 334	10, 648	1923	21, 229	377, 435, 543	17, 779
1909	13, 049	142, 496, 878	10, 920	1924	18, 660	336, 271, 335	18, 021

TABLE 41.—*Pennsylvania anthracite mined by undercutting machines, 1916–1924*

Year	Gross tons	Year	Gross tons
1916	1, 642, 416	1921	874, 237
1917	1, 745, 735	1922	448, 922
1918	1, 658, 495	1923	1, 079, 055
1919	1, 406, 433	1924	1, 271, 325
1920	837, 565		

STRIPPING OPERATIONS

Table 42.—*Coal recovered from steam-shovel strip pits, 1914–1924*

Year	Pennsylvania anthracite		Bituminous coal		Total	
	Number of shovels	Coal mined (net tons)	Number of shovels	Coal mined (net tons)	Number of shovels	Coal mined (net tons)
1914	(a)	(a)	48	1,280,946	48	1,280,946
1915	57	1,121,603	87	2,831,619	144	3,953,222
1916	105	1,987,800	111	3,933,395	216	5,921,195
1917	76	2,301,588	182	5,789,977	258	8,091,565
1918	82	2,360,183	276	8,288,245	358	10,648,428
1919	89	2,006,879	287	5,634,951	376	7,641,830
1920	96	2,054,441	312	8,859,553	408	10,913,994
1921	85	2,027,790	279	4,699,511	364	6,727,301
1922	69	949,745	379	9,886,431	448	10,836,176
1923	95	2,263,098	442	11,844,347	537	14,107,445
1924	95	1,865,677	420	13,606,954	515	15,472,631

[a] Not available.

TABLE 43.—*Summary of stripping operations that produced bituminous coal in 1924*

[For mines that recover coal both by stripping and by underground operations the returns do not permit separating men engaged in stripping from those engaged in other work. For this reason the figures of men employed represent all persons working at these mines, including those underground. The total tons produced by both methods at these same mines are also shown]

State and county	Number of strip pits	Number of shovels	Coal produced (net tons)		Total value at same mines	Men employed				Days worked	Per cent of county or State total that was mined by stripping
			Mined by stripping	Total at same mines		Underground		Surface	Total		
						Miners, loaders, etc.[a]	All others				
Alabama: Walker	10	19	370,081	643,440	$1,457,000	269	110	608	987	183	6.7
Arkansas:											
Franklin	6	10	146,862	146,862	438,000	--------	--------	248	248	151	64.0
Johnson and Sebastian	4	6	76,445	76,445	355,000	--------	--------	150	150	78	7.7
State total	10	16	223,307	223.307	793,000	--------	--------	398	398	123	15.4
Georgia: Walker	1	2	65,657	72,947	267,000	53	18	68	139	250	87.6
Illinois:											
Fulton, Jackson, Perry, and Saline	6	16	1,027,201	1,027,201	1,817,000	--------	--------	400	400	192	10.0
Vermilion	7	15	711,634	753,319	1,586,000	57	18	357	432	168	21.0
Williamson	4	11	557,025	595,805	982,000	30	10	131	171	198	6.0
State total	17	42	2,295,860	2,376,325	4,385,000	87	28	888	1,003	183	3.4
Indiana:											
Clay	6	11	367,719	367,719	654,000	--------	--------	215	215	174	50.3
Greene	6	12	453,817	453,817	770,000	--------	--------	275	275	109	24.2
Owen	3	4	102,535	102,535	213,000	--------	--------	85	85	139	95.2
Pike	4	14	895,672	895,672	2,077,000	--------	--------	460	460	170	44.8
Sullivan and Vigo	4	8	301,351	301,351	596,000	--------	--------	181	181	176	3.0
Warrick	4	8	390,095	390,095	686,000	--------	--------	321	321	171	45.4
State total	27	57	2,511,189	2,511,189	4,996,000	--------	--------	1,537	1,537	159	11.7
Kansas:											
Cherokee	10	15	451,153	451,153	1,164,000	--------	--------	254	254	106	54.5
Crawford	16	18	343,921	343,921	960,000	--------	--------	347	347	129	10.7
State total	26	33	795,074	795,074	2,124,000	--------	--------	601	601	119	18.7

Kentucky:											
Hopkins	7	19	965,893	986,451	1,545,000	25	10	430	465	201	27.2
McCreary, McLean, Muhlenberg, and Webster	4	7	159,786	159,786	259,000			146	146	114	3.9
Ohio	2	4	175,176	175,176	228,000			170	170	108	34.6
State total	13	30	1,300,855	1,321,413	2,032,000	25	10	746	781	164	2.9
Missouri:											
Barton	14	19	714,318	714,318	2,098,000			632	632	117	96.5
Bates and Henry	5	8	265,382	365,382	633,000			182	182	187	83.0
State total	19	27	979,700	979,700	2,731,000			814	814	132	39.5
North Dakota:											
Burke	8	7	310,179	310,179	683,000			144	144	157	99.8
Divide, McLean, Mercer, Stark, and Ward	5	2	124,005	135,330	273,000	17	4	87	108	160	24.4
State total	13	9	434,184	445,509	956,000	17	4	231	252	171	36.2
Ohio:											
Belmont, Carroll, Columbiana, Hocking, Jackson, Muskingum, and Stark	12	16	173,367	207,221	395,000	32	13	200	245	128	1.3
Harrison	16	40	1,749,584	1,749,584	2,701,000	116	36	852	1,004	159	69.0
Jefferson	7	22	510,032	542,142	856,000	25	5	297	327	132	11.6
Perry	6	15	395,849	395,849	688,000			334	334	113	20.5
Tuscarawas	5	6	37,851	46,854	94,000	7	3	47	57	90	3.3
State total	46	99	2,866,683	2,941,650	4,734,000	180	57	1,730	1,967	141	9.4
Oklahoma.											
Haskell	4	4	49,616	9,616	248,000			83	83	137	68.1
Le Flore, Muskogee, Okmulgee, Rogers, and Wagoner	6	11	103,312	110,812	359,000	31	8	160	199	146	9.6
Tulsa	3	6	159,181	159,181	553,000			139	139	246	89.9
State total	13	21	312,109	319,609	1,160,000	31	8	382	421	177	13.4
Pennsylvania.											
Allegheny	6	9	232,243	312,641	722,000	63	15	176	254	191	1.6
Armstrong, Beaver, Center, Clinton, Jefferson, and Somerset	7	13	289,580	311,780	644,000	18	6	225	249	242	1.8
Clearfield	5	5	27,544	57,908	120,000	43	8	41	92	167	.5
Washington	5	18	254,535	274,298	415,000	60	15	278	353	102	1.4
Westmoreland	8	9	98,916	553,101	1,009,000	208	88	150	446	193	.6
State total	31	54	902,818	1,509,728	2,910,000	392	132	870	1,394	177	.7
West Virginia: Harrison	4	7	244,448	244,448	349,000			94	94	152	4.5
Other States [b]	4	4	304,989	309,889	598,000	7	2	55	64	224	3.2
Grand total	234	420	13,606,954	14,694,228	29,492,000	1,061	369	9,022	10,452	160	2.8

[a] Also includes shot firers.

[b] California, Iowa, Montana, and Texas.

COAL WASHING

TABLE 44.—*Bituminous coal washed at mines, 1906–1924*

Year	Coal washed (net tons)	Cleaned coal (net tons)	Refuse (net tons)	Percentage of cleaned coal to total output
1906	10, 425, 455	9, 251, 946	1, 173, 509	2. 7
1907	12, 981, 514	11, 269, 518	1, 711, 996	2. 9
1908	13, 660, 478	11, 870, 438	1, 790, 040	3. 6
1909	16, 541, 874	14, 443, 147	2, 098, 727	3. 8
1910	18, 395, 382	16, 035, 387	2, 359, 995	3. 8
1911	(a)	(a)	(a)	(a)
1912	19, 844, 517	17, 538, 572	2, 305, 945	3. 9
1913	25, 051, 801	22, 069, 691	2, 982, 110	4. 6
1914	22, 848, 647	20, 264, 141	2, 584, 506	4. 8
1915	23, 472, 036	20, 873, 727	2, 598, 309	4. 7
1916	25, 632, 974	22, 922, 218	2, 710, 756	4. 6
1917	28, 587, 137	25, 483, 696	3, 103, 441	4. 6
1918	25, 119, 548	22, 017, 293	3, 102, 255	3. 8
1919	19, 187, 837	16, 884, 062	2, 303, 775	3. 6
1920	20, 595, 750	17, 984, 289	2, 611, 461	3. 2
1921	15, 355, 169	13, 628, 724	1, 726, 445	3. 3
1922	(b)	(b)	(b)	(b)
1923	22, 364, 986	20, 140, 385	2, 224, 601	3. 6
1924	(b)	(b)	(b)	(b)

[a] The returns for 1911 were apparently incomplete, but the error can not now be corrected. As published they showed 12,355,716 tons washed and 10,830,823 tons of cleaned coal, equivalent to 2.7 per cent of the total output.

[b] Canvass not made.

TABLE 45.—*Bituminous coal washed at mines, by States, in 1923*

State	Coal washed (net tons)	Cleaned coal (net tons)	Refuse (net tons)	Percentage of cleaned coal to total State output
Alabama	13, 570, 913	12, 285, 695	1, 285, 218	60. 1
Colorado	359, 638	322, 399	37, 239	3. 1
Georgia	25, 917	24, 161	1, 756	32. 0
Illinois	1, 718, 971	1, 520, 819	198, 152	1. 9
Indiana	115, 982	99, 858	16, 124	. 4
Kentucky	342, 618	306, 436	36, 182	. 7
Michigan	218, 180	197, 154	21, 026	16. 8
Missouri	118, 000	94, 950	23, 050	2. 8
Montana	214, 939	212, 297	2, 642	6. 7
Ohio	60, 944	54, 484	6, 460	. 1
Oregon	(a)	(a)	(a)	(a)
Pennsylvania	2, 705, 955	2, 496, 843	209, 112	1. 5
Tennessee	445, 975	390, 275	55, 700	6. 5
Texas	9, 549	6, 655	2, 894	. 6
Virginia	291, 874	261, 346	30, 528	2. 2
Washington [a]	907, 339	722, 320	185, 019	24. 7
West Virginia	1, 258, 192	1, 144, 693	113, 499	1. 1
	22, 364, 986	20, 140, 385	2, 224, 601	3. 6

[a] Washington includes Oregon.

NUMBER AND SIZE OF MINES

TABLE 46.—*Number and production of bituminous coal mines (including wagon mines), by size classes, in 1923* [a]

State	Class 1 (more than 200,000 tons)					Class 2 (100,000 to 200,000 tons)					Class 3 (50,000 to 100,000 tons)				
	Mines		Production			Mines		Production			Mines		Production		
	Number	Percentage	Total (net tons)	Average per mine (net tons)	Percentage	Number	Percentage	Total (net tons)	Average per mine (net tons)	Percentage	Number	Percentage	Total (net tons)	Average per mine (net tons)	Percentage
Alabama	24	7.6	8,693,515	362,230	42.5	38	12.1	5,163,470	135,881	25.2	49	15.5	3,277,177	66,881	16.0
Alaska, California, Idaho, and Oregon															
Arkansas						1	.7	125,139	125,139	9.6	4	2.7	277,186	69,297	21.4
Colorado	15	5.9	3,892,913	259,527	37.6	19	7.5	2,647,235	139,328	25.6	31	12.3	2,175,250	70,169	21.1
Georgia											1	33.3	72,270	72,270	95.6
Illinois	134	21.4	59,354,052	442,941	74.8	82	13.1	12,090,380	147,444	15.2	64	10.2	4,782,678	74,729	6.1
Indiana	48	11.9	15,531,713	323,577	59.2	34	8.4	4,836,532	142,251	18.4	45	11 2	3,451,305	76,696	13.1
Iowa	4	2.4	1,268,408	317,102	22.2	11	6.7	1,500,835	136,440	26.3	19	11.5	1,405,515	73,974	24.6
Kansas						8	2.1	1,151,141	143,893	25.9	23	5.9	1,738,097	75.569	39.1
Kentucky	36	2.9	11,562,395	321,178	25.8	110	8.7	15,116,475	137,423	33.8	132	10.5	9,656,262	73,154	21.6
Maryland						3	2.0	377,399	125,800	16.5	12	8.2	849,358	70,780	37.1
Michigan	2	14.3	478,049	239,025	40.8	3	21.4	355,619	118,540	30.3	2	14.3	167,536	83,768	14.3
Missouri	1	.4	308,332	308,332	9.1	4	1.7	493,773	123,444	14.5	18	7.9	1,222,578	67.921	35.9
Montana	4	6.5	2,014,523	503,630	64.0	3	4.8	407,551	135,850	13.0	5	8.1	382,093	76,419	12.1
New Mexico	2	3.1	606,105	303,053	20.8	14	21.5	1,701,203	121,515	58.3	3	4.6	224,054	74,685	7.7
North Carolina															
North Dakota	1	.7	226,491	226,491	16.3	1	.6	113,378	113,378	8.2	3	2.1	209,644	69,881	15.1
Ohio	58	4.7	16,473,083	284,018	40.6	84	6.8	11,802,563	140,507	29.1	76	6.2	5,426,571	71,402	13.4
Oklahoma	1	.6	243,764	243,764	8.4	3	1.8	493,318	164,439	17.1	9	5.4	678,493	75,388	23.5
Pennsylvania	247	6.8	92,725,666	375,407	53.9	234	6.4	32,933,317	140,741	19.2	287	7.9	20,569,474	71,671	12.0
South Dakota															
Tennessee	3	1.3	790,556	263,516	13.1	11	4.7	1,456,666	132,424	24.1	24	10.4	1,719,587	71,649	28.5
Texas											9	20.5	465,463	51,718	39.2
Utah	10	26.3	2,866,410	286,641	60.7	8	21.1	1,283,160	160,395	27.2	6	15.8	492,000	82,000	10.4
Virginia	19	9.7	7,022,544	269,608	59.7	12	6.2	1,820,146	151,678	15.5	20	10.2	1,419,589	70,979	12.1
Washington	4	7.0	1,071,075	267,769	36.6	8	14.0	1,207,517	150,940	41.3	4	7.1	257,827	64,457	8.8
West Virginia	122	6.8	37,183,184	304,780	34.5	223	12.4	30,647,525	137,433	28.4	318	17.7	22,626,776	71,153	21.0
Wyoming	13	19.4	3,556,360	273,566	46.9	21	31.3	3,079,906	146,662	40.7	12	17.9	795,294	66,275	10.5
	748	6.4	265,869,138	355,440	47.1	935	8.0	130,804,248	139,898	23.2	1,176	10.0	84,342,077	71,719	14.9

[a] Note that this table represents mines, not companies, for which the showing would be very different.

TABLE 46.—*Number and production of bituminous coal mines (including wagon mines), by size classes, in 1923*—Continued

State	Class 4 (10,000 to 50,000 tons)					Class 5 (less than 10,000 tons)					Total		
	Mines		Production			Mines		Production			Mines	Production (net tons)	
	Number	Percentage	Total (net tons)	Average per mine (net tons)	Percentage	Number	Percentage	Total (net tons)	Average per mine (net tons)	Percentage		Total	Average per mine
Alabama	108	34.3	3,021,150	27,974	14.8	96	30.5	302,337	3,149	1.5	315	20,457,649	64,945
Alaska, California, Idaho, and Oregon	4	23.5	118,877	29,719	85.0	13	76.5	21,015	1,616	15.0	17	139,892	8,229
Arkansas	29	19.9	624,843	21,546	48.2	112	76.7	269,724	2,408	20.8	146	1,296,892	8,883
Colorado	49	19.4	1,285,610	26,237	12.4	139	54.9	345,210	2,484	3.3	253	10,346,218	40,894
Georgia						2	66.7	3,350	1,675	4.4	3	75,620	25,207
Illinois	98	15.7	2,379,687	24,283	3.0	247	39.6	703,278	2,847	.9	625	79,310,075	126,896
Indiana	72	17.8	1,919,070	26,654	7.3	205	50.7	490,479	2,392	2.0	404	26,229,099	64,924
Iowa	51	30.9	1,297,474	25,441	22.7	80	48.5	238,503	2,981	4.2	165	5,710,735	34,610
Kansas	35	9.0	781,867	22,339	17.6	324	83.0	772,044	7,388	17.4	390	4,443,149	11,393
Kentucky	267	21.3	7,226,330	27,065	16.1	711	56.6	1,215,855	1,710	2.7	1,256	44,777,317	35,651
Maryland	32	21.9	817,464	25,546	35.9	99	67.9	241,705	2,441	10.5	146	2,285,926	15,657
Michigan	5	35.7	166,371	33,274	14.2	2	14.3	4,500	2,250	.4	14	1,172,075	83,726
Missouri	42	18.3	984,340	23,437	28.9	164	71.7	394,128	2,403	11.6	229	3,403,151	14,861
Montana	9	14.5	241,003	26,778	7.7	41	66.1	102.508	2,500	3.2	62	3,147,678	50,769
New Mexico	12	18.5	337,198	28,100	11.6	34	52.3	46,613	1,371	1.6	65	2,915,173	44,849
North Carolina	2	100.0	36,019	18,010	100.0						2	36,019	18,010
North Dakota	25	17.4	572,146	22,886	41.4	114	79.2	263,741	2,314	19.0	144	1,385,400	9,621
Ohio	223	18.1	5,184,100	23,247	12.8	792	64.2	1,660,126	2,096	4.1	1,233	40,546,443	32,884
Oklahoma	55	33.8	1,241,487	22,572	43.0	95	58.4	227,976	2,400	8.0	163	2,885,038	17,699
Pennsylvania	872	24.0	20,824,245	23,881	12.1	1,997	54.9	4,827,211	2,417	2.8	3,637	171,879,913	47,259
South Dakota						15	100.0	10,379	692	100.0	15	10,379	692
Tennessee	68	29.3	1,711,550	25,170	28.3	126	54.3	361,909	2,872	6.0	232	6,040,268	26,036
Texas	27	61.4	672,949	24,924	56.7	8	18.1	48,917	6,115	4.1	44	1,187,329	26,985
Utah	2	5.2	45,938	22,969	1.0	12	31.6	32,709	2,726	.7	38	4,720,217	124,216
Virginia	50	25.6	1,273,741	25,475	10.8	94	48.3	225,623	2,400	1.9	195	11,761,643	60,316
Washington	13	22.8	313,416	24,109	10.7	28	49.1	76,557	2,734	2.6	57	2,926,392	51,340
West Virginia	589	32.8	15,587,203	26,464	14.4	546	30.3	1,855,253	3,398	1.7	1,798	107,899,941	60,011
Wyoming	3	4.5	105,283	35,094	1.4	18	26.9	38,188	2,122	.5	67	7,575,031	113,060
	2,742	23.4	68,769,361	25,080	12.2	6,114	52.2	14,779,838	2,417	2.6	11,715	564,564,662	48,192

TABLE 47.—*Number and production of bituminous coal mines (excluding wagon mines), by size classes, in 1924* [a]

[Wagon mines are excluded because no canvass of them was made for 1924]

State	Class 1 A (more than 500,000 tons)					Class 1 B (200,000 to 500,000 tons)					Class 2 (100,000 to 200,000 tons)					Class 3 (50,000 to 100,000 tons)				
	Mines		Production			Mines		Production			Mines		Production			Mines		Production		
	Number	Percentage	Total (net tons)	Average per mine (net tons)	Percentage	Number	Percentage	Total (net tons)	Average per mine (net tons)	Percentage	Number	Percentage	Total (net tons)	Average per mine (net tons)	Percentage	Number	Percentage	Total (net tons)	Average per mine (net tons)	Percentage
Alabama	4	1.7	3,164,081	791,020	16.5	17	7.2	5,050,160	297,068	26.4	27	11.3	3,861,196	143,007	20.2	49	20.6	3,882,027	79,225	20.3
Alaska																1	12.5	51,426	51,426	51.6
Arkansas											1	1.2	122,099	122,099	8.4	7	8.1	452,232	64,605	31.2
California, Idaho, Nebraska and Oregon																				
Colorado						15	6.5	3,860,126	257,342	37.0	21	9.1	3,037,942	144,664	29.1	27	11.7	1,910,957	70,776	18.3
Georgia																1	50.0	72,947	72,947	97.3
Illinois	46	9.4	34,357,009	746,891	50.3	60	12.3	18,690,508	311,508	27.4	59	12.1	8,246,762	139,775	12.1	58	11.9	4,361,333	75,195	6.4
Indiana	3	1.2	1,911,657	637,219	8.9	34	13.7	10,078,878	296,438	46.9	33	13.3	4,898,610	148,443	22.8	39	15.7	2,816,277	72,212	13.1
Iowa						4	1.6	1,225,672	306,418	22.4	11	4.3	1,527,983	138,908	27.9	14	5.5	973,294	69,521	17.8
Kansas						2	.9	460,152	230,076	10.8	7	3.1	901,772	128,825	21.2	18	7.9	1,267,966	70,443	29.9
Kentucky:																				
Eastern	4	.8	3,337,816	834,454	9.2	42	8.5	10,440,018	248,572	28.9	84	17.0	11,437,954	136,166	31.7	92	18.5	6,750,239	73,372	18.7
Western						8	4.9	2,053,810	256,726	22.8	25	15.2	3,373,128	134,925	37.4	23	14.0	1,659,521	72,153	18.4
Maryland											4	4.3	501,425	125,356	23.5	7	7.5	456,076	65,154	21.4
Michigan						2	22.2	479,036	239,518	57.6	1	11.1	145,664	145,664	17.5	2	22.2	144,317	72,159	17.4
Missouri																17	13.4	1,213,406	71,377	48.9
Montana	2	2.9	1,253,784	626,892	43.2	1	1.5	202,167	202,167	7.0	5	7.3	839,724	167,945	28.9	4	5.9	262,662	65,665	9.0
New Mexico	1	2.4	500,061	500,061	17.9	1	2.4	241,507	241,507	8.7	11	26.2	1,437,376	130,670	51.6	6	14.3	401,327	66,888	14.4
North Carolina																				
North Dakota											3	2.3	410,312	136,771	34.2	3	2.3	200,889	66,963	16.7
Ohio	3	.4	1,614,613	538,204	5.3	40	5.3	11,560,254	289,006	37.9	56	7.5	7,800,761	139,299	25.6	59	7.9	4,167,954	70,643	13.7
Oklahoma											3	3.2	365,600	121,867	15.7	8	8.5	537,375	67,172	23.1
Pennsylvania	47	2.2	31,184,295	663,496	23.9	134	6.3	39,466,552	294,526	30.2	196	9.2	27,239,447	138,977	20.9	210	9.9	15,177,822	72,275	11.6
South Dakota																				
Tennessee											13	9.4	1,793,852	137,980	39.4	15	10.8	1,160,034	77,336	25.5
Texas											1	2.3	111,117	111,117	9.7	5	11.4	283,964	56,792	24.8
Utah						8	20.5	2,383,637	297,955	53.1	9	23.1	1,455,520	161,724	32.4	7	17.9	507,661	72,523	11.3
Virginia	4	3.5	2,692,815	673,203	25.2	18	15.7	4,711,967	261,776	44.1	6	5.2	864,469	144,078	8.1	20	17.4	1,453,980	72,699	13.6
Washington						5	8.6	1,273,623	254,724	48.0	5	8.7	649,222	129,844	24.5	6	10.3	413,483	68,914	15.6
West Virginia	15	1.2	8,551,308	570,087	8.4	117	9.6	33,990,720	290,519	33.4	216	17.7	30,971,374	143,386	30.5	236	19.3	16,677,689	70,668	16.4
Wyoming						9	14.5	2,601,237	289,026	38.5	22	35.5	3,224,150	146,552	47.7	9	14.5	709,698	78,855	10.5
	129	1.7	88,567,439	686,569	18.3	517	6.8	148,770,024	287,756	30.7	819	10.8	115,217,459	140,681	23.8	943	12.4	67,966,556	72,075	14.1

[a] Note that this table represents mines, not companies, for which the showing would be very different.

TABLE 47.—*Number and production of bituminous coal mines (excluding wagon mines), by size classes, in 1924*—Continued

State	Class 4 (10,000 to 50,000 tons)					Class 5 (less than 10,000 tons)					Total		
	Mines		Production			Mines		Production			Mines	Production (net tons)	
	Number	Percentage	Total (net tons)	Average per mine (net tons)	Percentage	Number	Percentage	Total (net tons)	Average per mine (net tons)	Percentage		Total	Average per mine
Alabama	90	37.8	2,951,578	32,795	15.4	51	21.4	221,142	4,336	1.2	238	19,130,184	80,379
Alaska	1	12.5	35,134	35,134	35.3	6	75.0	13,103	2,184	13.1	8	99,663	12,458
Arkansas	28	32.6	699,768	24,992	48.2	50	58.1	177,404	3,548	12.2	86	1,451,503	16,878
California, Idaho, Nebraska, and Oregon						9	100.0	16,953	1,884	100.0	9	16,953	1,884
Colorado	47	20.3	1,339,519	28,500	12.8	121	52.4	295,554	2,443	2.8	231	10,444,098	45,213
Georgia						1	50.0	2,000	2,000	2.7	2	74,947	37,474
Illinois	88	18.0	2,085,227	23,696	3.0	177	36.3	582,442	3,291	.8	488	68,323,281	140,007
Indiana	57	23.0	1,479,728	25,960	6.9	82	33.1	295,063	3,598	1.4	248	21,480,213	86,614
Iowa	49	19.1	1,275,907	26,039	23.4	178	69.5	465,594	2,616	8.5	256	5,468,450	21,361
Kansas	48	21.0	1,078,805	22,475	25.4	153	67.1	539,038	3,523	12.7	228	4,247,733	18,630
Kentucky:													
Eastern	142	28.6	3,684,213	25,945	10.2	132	26.6	476,893	3,613	1.3	496	36,127,133	72,837
Western	62	37.8	1,775,992	28,645	19.7	46	28.1	157,620	3,426	1.7	164	9,020,071	55,000
Maryland	37	39.8	1,020,423	27,579	47.8	45	48.4	155,779	3,462	7.3	93	2,133,703	22,943
Michigan	3	33.3	58,503	19,501	7.1	1	11.2	3,500	3,500	.4	9	831,020	92,335
Missouri	40	31.5	988,748	24,719	39.9	70	55.1	278,726	3,982	11.2	127	2,480,880	19,534
Montana	8	11.8	194,793	24,349	6.7	48	70.6	152,235	3,171	5.2	68	2,905,365	42,726
New Mexico	7	16.7	167,941	23,992	6.0	16	38.0	37,851	2,366	1.4	42	2,786,063	66,335
North Carolina	2	100.0	57,094	28,547	100.0						2	57,094	28,547
North Dakota	17	12.9	355,578	20,916	29.6	109	82.5	233,748	2,144	19.5	132	1,200,527	9,095
Ohio	172	22.9	4,021,634	23,382	13.2	420	56.0	1,307,791	3,114	4.3	750	30,473,007	40,631
Oklahoma	45	47.9	1,237,363	27,497	53.1	38	40.4	189,277	4,981	8.1	94	2,329,615	24,783
Pennsylvania	591	27.9	14,139,085	23,924	10.8	944	44.5	3,426,572	3,630	2.6	2,122	130,633,773	61,562
South Dakota						16	100.0	12,043	753	100.0	16	12,043	753
Tennessee	56	40.2	1,405,597	25,100	30.8	55	39.6	197,072	3,583	4.3	139	4,556,555	32,781
Texas	31	70.4	706,379	22,786	61.5	7	15.9	45,551	6,507	4.0	44	1,147,011	26,068
Utah	4	10.3	123,360	30,840	2.8	11	28.2	17,979	1,634	.4	39	4,488,157	115,081
Virginia	34	29.5	847,658	24,931	7.9	33	28.7	122,575	3,714	1.1	115	10,693,464	92,987
Washington	12	20.7	251,091	20,924	9.5	30	51.7	66,248	2,208	2.4	58	2,653,667	45,753
West Virginia	369	30.3	10,428,950	28,263	10.3	267	21.9	1,042,856	3,906	1.0	1,220	101,662,897	83,330
Wyoming	7	11.3	195,766	27,966	2.9	15	24.2	26,617	1,774	.4	62	6,757,468	108,991
	2,047	27.0	52,605,834	25,699	10.9	3,131	41.3	10,559,226	3,372	2.2	7,586	483,686,538	63,760

TABLE 48.—*Number and yearly output of commercial bituminous coal mines, by size classes, 1905–1924* [a]

[Exclusive of wagon mines]

Year	Class 1 (more than 200,000 tons) [b]	Class 2 (100,000 to 200,000 tons)	Class 3 (50,000 to 100,000 tons)	Class 4 (10,000 to 50,000 tons)	Class 5 (less than 10,000 tons)	Total
Number of mines:						
1905	411	612	808	1,514	1,715	5,060
1910	618	763	960	1,568	1,909	5,818
1913	694	837	959	1,558	1,728	5,776
1917	792	914	1,044	1,996	2,193	6,939
1918	821	929	1,198	2,636	2,735	8,319
1919	550	854	1,181	2,784	3,625	8,994
1920	701	1,031	1,279	3,160	2,750	8,921
1921	482	807	1,003	2,346	3,400	8,038
1922	416	848	1,084	3,139	3,812	9,299
1923	748	935	1,176	2,742	3,730	9,331
1924	646	819	943	2,047	3,131	7,586
Net tons produced:						
1905	126,499,000	85,920,000	57,386,000	38,995,000	6,034,000	314,834,000
1910	191,519,000	107,052,000	68,858,000	42,282,000	6,561,000	416,272,000
1913	241,463,000	118,476,000	69,018,000	42,292,000	6,280,000	477,529,000
1917	285,366,000	129,486,000	74,894,000	51,596,000	8,824,000	550,166,000
1918	281,267,000	131,027,000	87,143,000	67,453,000	11,387,000	578,277,000
1919	174,848,000	120,926,000	84,625,000	71,334,000	13,198,000	464,931,000
1920	237,468,000	142,750,000	90,669,000	82,129,000	10,716,000	563,732,000
1921	162,438,000	115,607,000	71,160,000	56,099,000	10,618,000	415,922,000
1922	131,876,000	117,195,000	77,287,000	77,203,000	15,248,000	418,809,000
1923	265,869,000	130,804,000	84,342,000	68,769,000	13,639,000	563,423,000
1924	237,338,000	115,217,000	67,967,000	52,606,000	10,559,000	483,687,000
Percentage of total number of mines:						
1905	8.1	12.1	16.0	29.9	33.9	100.0
1910	10.6	13.1	16.5	27.0	32.8	100.0
1913	12.0	14.5	16.6	27.0	29.9	100.0
1917	11.4	13.2	15.0	28.8	31.6	100.0
1918	9.8	11.2	14.4	31.7	32.9	100.0
1919	6.1	9.5	13.1	31.0	40.3	100.0
1920	7.9	11.6	14.3	35.4	30.8	100.0
1921	6.0	10.0	12.5	29.2	42.3	100.0
1922	4.5	9.1	11.7	33.7	41.0	100.0
1923	8.0	10.0	12.6	29.4	40.0	100.0
1924	8.5	10.8	12.4	27.0	41.3	100.0
Percentage of total tonnage:						
1905	40.2	27.3	18.2	12.4	1.9	100.0
1910	46.0	25.7	16.5	10.2	1.6	100.0
1913	50.6	24.8	14.4	8.9	1.3	100.0
1917	51.9	23.5	13.6	9.4	1.6	100.0
1918	48.6	22.7	15.1	11.6	2.0	100.0
1919	37.6	26.0	18.2	15.4	2.8	100.0
1920	42.1	25.3	16.1	14.6	1.9	100.0
1921	39.1	27.8	17.1	13.5	2.5	100.0
1922	31.5	28.0	18.5	18.4	3.6	100.0
1923	47.2	23.2	15.0	12.2	2.4	100.0
1924	49.0	23.8	14.1	10.9	2.2	100.0

[a] This table shows mines, not companies, and should not be confused with other tables that include country banks and many wagon mines shipping by rail.

[b] Figures for 1924 include class 1A and 1B.

NUMBER OF IDLE, PART-TIME, AND FULL-TIME MINES

Table 49.—*Number and percentage of mines reporting weekly to the United States Geological Survey that were closed and number working part time and full time, January to December, 1924*

Week ended—	Total number reporting	Mines shut down entire week		Mines working—													
				1 and less than 8 hours		8 and less than 16 hours		16 and less than 24 hours		24 and less than 32 hours		32 and less than 40 hours		40 and less than 48 hours		Full time of 48 hours or more	
		Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Jan. 5	2,447	883	36.0	44	1.8	168	6.9	300	12.3	354	14.5	345	14.1	278	11.4	75	3.0
12	2,533	843	33.3	21	.8	117	4.6	221	8.7	304	12.0	330	13.0	345	13.7	352	13.9
19	2,494	792	31.8	37	1.5	116	4.6	232	9.3	313	12.5	345	13.8	338	13.6	321	12.9
26	2,435	797	32.7	33	1.4	95	3.9	210	8.6	346	14.2	350	14.4	324	13.3	280	11.5
Feb. 2	2,369	735	31.0	39	1.6	114	4.8	264	11.1	361	15.3	348	14.7	269	11.4	239	10.1
9	2,400	719	30.0	33	1.4	124	5.2	284	11.8	350	14.6	401	16.6	274	11.4	215	9.0
16	2,364	711	30.2	24	1.0	118	5.0	273	11.5	395	16.7	407	17.2	239	10.1	197	8.3
23	2.175	669	30.8	25	1.1	151	6.9	298	13.7	343	15.8	370	17.0	208	9.6	111	5.1
Mar. 1	2,414	691	28.5	28	1.2	147	6.1	265	11.0	396	16.4	407	16.9	287	11.9	193	8.0
8	2,362	748	31.8	34	1.4	184	7.8	294	12.4	317	13.4	340	14.4	255	10.8	190	8.0
15	2,379	814	34.3	38	1.6	158	6.6	293	12.3	366	15.4	286	12.0	223	9.4	201	8.4
22	2,418	825	34.2	49	2.0	170	7.0	305	12.6	348	14.4	261	10.8	240	9.9	220	9.1
29	2,387	925	38.7	41	1.7	218	9.1	333	14.0	281	11.8	216	9.0	164	6.9	209	8.8
Apr. 5	2,380	1,058	44.5	77	3.2	282	11.9	301	12.6	260	10.9	202	8.5	119	5.0	81	3.4
12	2,194	1,013	46.1	50	2.3	208	9.4	286	13.0	260	11.9	142	6.5	124	5.7	111	5.1
19	2,253	1,052	46.7	63	2.8	194	8.6	297	13.2	251	11.1	179	8.0	108	4.8	109	4.8
26	2,310	1,136	49.1	44	1.9	217	9.4	274	11.9	247	10.7	173	7.5	124	5.4	95	4.1
May 3	2,406	1,169	48.7	52	2.2	198	8.2	285	11.8	275	11.4	162	6.7	142	5.9	123	5.1
10	2,392	1,175	49.1	41	1.7	195	8.2	288	12.0	246	10.3	170	7.1	133	5.6	144	6.0
17	2,410	1,190	49.3	38	1.6	187	7.8	254	10.5	272	11.2	189	7.8	139	5.8	141	5.9
24	2,404	1,171	48.6	36	1.5	172	7.2	278	11.6	247	10.3	211	8.8	145	6.0	144	6.0
31	2,329	1,087	46.7	44	1.9	170	7.3	273	11.7	332	14.2	209	9.0	149	6.4	65	2.8
June 7	2,420	1,145	47.3	31	1.3	161	6.7	252	10.4	248	10.3	250	10.3	173	7.1	160	6.6
14	2,418	1,176	48.6	28	1.1	161	6.7	259	10.7	248	10.3	233	9.6	173	7.2	140	5.8
21	2,367	1,101	46.5	40	1.7	157	6.6	238	10.1	260	11.0	239	10.1	175	7.4	157	6.6
28	2,422	1,108	45.8	31	1.3	148	6.1	253	10.5	277	11.4	250	10.3	197	8.1	158	6.5

July 5	2,416	1,123	46.5	44	1.8	200	8.2	342	14.1	342	14.2	281	11.7	77	3.2	7	.3
12	2,369	1,113	47.0	20	.9	136	5.7	219	9.3	257	10.8	207	8.7	226	9.5	191	8.1
19	2,391	1,103	46.1	29	1.2	136	5.7	238	10.0	288	12.0	216	9.0	205	8.6	176	7.4
26	2,530	1,118	44.2	32	1.3	158	6.2	250	9.9	283	11.2	234	9.3	244	9.6	211	8.3
Aug. 2	2,415	1,108	45.9	27	1.1	122	5.1	240	9.9	307	12.7	243	10.1	189	7.8	179	7.4
9	2,304	1,076	46.6	28	1.2	144	6.3	197	8.6	246	10.7	231	10.0	194	8.4	188	8.2
16	2,298	1,059	46.1	30	1.3	126	5.5	222	9.7	251	10.9	237	10.3	221	9.6	152	6.6
23	2,274	1,020	44.8	29	1.3	107	4.7	199	8.8	274	12.0	207	9.1	232	10.2	206	9.1
30	2,514	1,101	43.8	21	.8	117	4.7	192	7.6	253	10.1	272	10.8	303	12.1	255	10.1
Sept. 6	2,509	1,076	42.9	33	1.3	126	5.0	216	8.6	326	13.0	300	12.0	317	12.6	115	4.6
13	2,407	1,008	41.8	19	.8	91	3.8	147	6.1	222	9.2	291	12.1	336	14.0	293	12.2
20	2,389	1,032	43.2	19	.8	71	3.0	139	5.8	220	9.2	263	11.0	350	14.7	295	12.3
27	2,427	1,013	41.7	23	.9	79	3.3	151	6.2	218	9.0	305	12.6	335	13.8	303	12.5
Oct. 4	2,412	987	40.9	14	.6	74	3.1	150	6.2	218	9.0	309	12.8	311	12.9	349	14.5
11	1,972	645	32.7	7	.4	47	2.4	107	5.4	177	9.0	281	14.2	355	18.0	353	17.9
18	1,967	646	32.8	10	.5	39	2.0	114	5.8	179	9.1	287	14.6	329	16.7	363	18.5
25	1,947	631	32.3	7	.4	60	3.1	109	5.6	218	11.2	278	14.3	335	17.2	309	15.9
Nov. 1	1,943	618	31.8	5	.3	60	3.1	111	5.7	228	11.7	292	15.0	342	17.6	287	14.8
8	1,978	648	32.8	11	.6	67	3.4	154	7.8	250	12.6	355	17.9	332	16.8	161	8.1
15	1,931	598	31.0	3	.2	59	3.0	98	5.1	198	10.2	292	15.1	398	20.6	285	14.8
22	1,905	575	30.2	9	.5	51	2.7	110	5.7	203	10.6	285	15.0	330	17.3	342	18.0
29	1,946	608	31.3	16	.8	65	3.3	125	6.4	271	13.9	334	17.2	406	20.9	121	6.2
Dec. 6	1,951	597	30.6	12	.6	46	2.4	121	6.2	216	11.1	281	14.4	303	15.5	375	19.2
13	1,914	577	30.2	8	.4	73	3.8	104	5.4	207	10.8	275	14.4	364	19.0	306	16.0
20	1,917	586	30.6	7	.4	66	3.4	107	5.6	210	11.0	284	14.8	294	15.3	363	18.9
27	1,884	626	33.2	30	1.6	214	11.4	285	15.1	301	16.0	211	11.2	209	11.1	8	[a] .4

[a] Low percentage due to Christmas holiday.

NUMBER AND OUTPUT OF PRODUCERS AS DISTINCT FROM MINES

TABLE 50.—*Anthracite and bituminous coal producers in 1920, classified by size of output*

Size of output [a]	Number of producers in each size class		Percentage of total output in each size class	
	Anthracite	Bituminous	Anthracite	Bituminous
Less than 10,000 tons	47	8, 194	0. 2	2. 4
10,000 to 49,999 tons	38	2, 121	1. 0	9. 4
50,000 to 99,999 tons	21	727	1. 8	9. 0
100,000 to 499,999 tons	50	891	13. 6	31. 8
500,000 to 999,999 tons	5	109	4. 4	13. 2
1,000,000 to 4,999,999 tons	9	76	30. 2	27. 1
5,000,000 tons or more	4	4	48. 8	7. 1
	174	12, 122	100. 0	100. 0

[a] The unit used in this tonnage classification is the net ton of 2,000 pounds for bituminous coal producers, and the gross ton of 2,240 pounds for anthracite producers. This difference is offset by the large percentage of the anthracite output that is required for mine fuel.

VALUE OF COAL PRODUCED

TABLE 51.—*Production and value of bituminous and anthracite coal, 1923 and 1924, by States*

State	1923			1924		
	Net tons	Value		Net tons	Value	
		Total	Average per ton		Total	Average per ton
Alabama	20, 457, 649	$51, 624, 000	$2. 52	19, 130, 184	$44, 756, 000	$2. 34
Alaska	119, 826	755, 000	6. 30	99, 663	560, 000	5. 62
Arkansas	1, 296, 892	5, 192, 000	4. 01	1, 451, 503	5, 898, 000	4. 06
California, Idaho, Nebraska, and Oregon [a]	20, 066	79, 000	3. 94	16, 953	71, 000	4. 19
Colorado	10, 346, 218	33, 299, 000	3. 22	10, 444, 098	31, 863, 000	3. 05
Georgia	75, 620	327, 000	4. 32	74, 947	271, 000	3. 62
Illinois	79, 310, 075	198, 388, 000	2. 50	68, 323, 281	155, 260, 000	2. 27
Indiana	26, 229, 099	65, 046, 000	2. 48	21, 480, 213	46, 453, 000	2. 16
Iowa	5, 710, 735	20, 517, 000	3. 59	5, 468, 450	18, 097, 000	3. 31
Kansas	4, 443, 149	14, 275, 000	3. 21	4, 247, 733	12, 854, 000	3. 03
Kentucky	44, 777, 317	113, 542, 000	2. 54	45, 147, 204	84, 733, 000	1. 88
Maryland	2, 285, 926	6, 911, 000	3. 02	2, 133, 703	4, 629, 000	2. 17
Michigan	1, 172, 075	5, 545, 000	4. 73	831, 020	3, 602, 000	4. 33
Missouri	3, 403, 151	11, 575, 000	3. 40	2, 480, 880	8, 154, 000	3. 29
Montana	3, 147, 678	9, 652, 000	3. 07	2, 905, 365	8, 596, 000	2. 96
New Mexico	2, 915, 173	10, 668, 000	3. 66	2, 786, 063	9, 774, 000	3. 51
North Carolina	36, 019	132, 000	3. 66	57, 094	224, 000	3. 92
North Dakota	1, 385, 400	3, 275, 000	2. 36	1, 200, 527	2, 473, 000	2. 06
Ohio	40, 546, 443	98, 610, 000	2. 43	30, 473, 007	62, 011, 000	2. 03
Oklahoma	2, 885, 038	10, 874, 000	3. 77	2, 329, 615	8, 590, 000	3. 69
Pennsylvania (bituminous)	171, 879, 913	472, 217, 000	2. 75	130, 633, 773	295, 164, 000	2. 26
South Dakota	10, 379	25, 000	2. 41	12, 043	36, 000	2. 99
Tennessee	6, 040, 268	16, 515, 000	2. 73	4, 556, 555	9, 711, 000	2. 13
Texas	1, 187, 329	2, 162, 000	1. 82	1, 147, 011	1, 721, 000	1. 50
Utah	4, 720, 217	13, 657, 000	2. 89	4, 488, 157	12, 057, 000	2. 69
Virginia	11, 761, 643	32, 468, 000	2. 76	10, 693, 464	21, 823, 000	2. 04
Washington	2, 926, 392	10, 894, 000	3. 72	2, 653, 667	9, 689, 000	3. 65
West Virginia	107, 899, 941	285, 481, 000	2. 65	101, 662, 897	185, 229, 000	1. 82
Wyoming	7, 575, 031	20, 916, 000	2. 76	6, 757, 468	18, 327, 000	2. 71
Total bituminous	564, 564, 662	1, 514, 621, 000	2. 68	483, 686, 538	1, 062, 626, 000	2. 20
Pennsylvania anthracite	93, 339, 009	506, 787, 000	5. 43	87, 926, 862	477, 231, 000	5. 43
Grand total	657, 903, 671	2, 021, 408, 000	3. 07	571, 613, 400	1, 539, 857, 000	2. 69

[a] No production in Nebraska in 1923.

TABLE 52.—*Percentage of total value of bituminous coal produced in 1923 and 1924 by commercial operators that is represented by estimates, by States*

State	1923	1924	State	1923	1924
Alabama	8.3	7.9	Ohio	3.4	2.4
Arkansas	15.5	6.5	Oklahoma	18.4	19.5
Colorado	7.1	5.1	Pennsylvania	3.4	2.8
Illinois	5.8	2.2	South Dakota	1.4	.7
Indiana	9.4	5.5	Tennessee	6.8	1.1
Iowa	.2	22.8	Texas	21.0	23.5
Kansas	12.5	12.8	Utah	.2	.04
Kentucky	14.1	6.7	Virginia	3.2	.4
Maryland	3.5	11.7	Washington	16.3	31.0
Michigan	--------	.4	West Virginia	8.1	5.1
Missouri	6.8	2.5	Wyoming	3.3	5.2
Montana	2.4	.4	Other States	--------	25.8
New Mexico	.3	.1			
North Carolina	58.3	--------	United States	6.2	4.6
North Dakota	.9	1.6			

TABLE 53.—*Average value per net ton of coal at mines, 1880–1924*

Year	Anthracite [a]	Bituminous	Year	Anthracite [a]	Bituminous	Year	Anthracite [a]	Bituminous
1880	$1.47	$1.25	1895	$1.41	$0.86	1910	$1.90	$1.12
1881	2.01	1.12	1896	1.50	.83	1911	1.94	1.11
1882	2.01	1.12	1897	1.51	.81	1912	2.11	1.15
1883	2.01	1.07	1898	1.41	.80	1913	2.13	1.18
1884	1.79	.94	1899	1.46	.87	1914	2.07	1.17
1885	2.00	1.13	1900	1.49	1.04	1915	2.07	1.13
1886	1.95	1.05	1901	1.67	1.05	1916	2.30	1.32
1887	2.01	1.11	1902	1.84	1.12	1917	2.85	2.26
1888	1.91	1.00	1903	2.04	1.24	1918	3.40	2.58
1889	1.44	.99	1904	1.90	1.10	1919	4.14	2.49
1890	1.43	.99	1905	1.83	1.06	1920	4.85	3.75
1891	1.46	.99	1906	1.85	1.11	1921	5.00	2.89
1892	1.57	.99	1907	1.91	1.14	1922	5.01	3.02
1893	1.59	.96	1908	1.90	1.12	1923	5.43	2.68
1894	1.51	.91	1909	1.84	1.07	1924	5.43	2.20

[a] Averages for anthracite represent amounts per net ton and include all coal produced.

TABLE 54.—*Average value per net ton of coal at mines, by States, 1908–1924*

State	1908	1909	1910	1911	1912	1913	1914	1915	1916
Alabama	$1.26	$1.19	$1.26	$1.27	$1.29	$1.31	$1.34	$1.28	$1.37
Alaska	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	4.00
Arkansas	1.68	1.48	1.56	1.61	1.71	1.76	1.72	1.79	1.92
California	[b]3.19	[b]2.21	[b]2.74	[b]2.00	[b]2.33	[b]3.54	[c]2.85	[c]2.54	[c]2.12
Colorado	1.41	1.33	1.42	1.45	1.49	1.52	1.66	1.58	1.62
Georgia	1.38	1.41	1.46	[d]1.49	[d]1.49	1.41	[e]1.44	1.72	1.79
Idaho	4.02	4.27	3.92	[f]2.68	[f]3.14	[f]2.43	(a)	(a)	(a)
Illinois	1.05	1.05	1.14	1.11	1.17	1.14	1.12	1.10	1.25
Indiana	1.06	1.02	1.13	1.08	1.14	1.11	1.10	1.10	1.27
Iowa	1.63	1.65	1.75	1.73	1.80	1.79	1.79	1.78	1.86
Kansas	1.49	1.44	1.61	1.53	1.62	1.67	1.64	1.66	1.78
Kentucky	1.01	.94	.99	.99	1.02	1.05	1.02	1.01	1.19
Maryland	1.17	1.11	1.12	1.11	1.18	1.24	1.27	1.28	1.56
Michigan	1.81	1.79	1.91	1.78	1.99	1.99	1.99	2.05	2.25
Missouri	1.64	1.65	1.79	1.72	1.76	1.73	1.73	1.73	1.91
Montana	1.96	1.97	1.82	1.79	1.82	1.74	1.75	1.62	1.73
New Mexico	1.37	1.29	1.39	1.44	1.42	1.46	1.61	1.44	1.47
North Carolina	--------	--------	--------	(d)	(d)	--------	--------	--------	--------
North Dakota	1.63	1.56	1.49	1.43	1.53	1.52	1.52	1.45	1.49
Ohio	1.06	.99	1.05	1.03	1.07	1.10	1.13	1.08	1.33
Oklahoma	2.03	2.00	2.22	2.05	2.14	2.05	2.06	2.01	2.09
Oregon	2.74	2.69	3.48	2.32	2.60	2.53	2.78	2.84	2.68
Pennsylvania (bituminous)	1.01	.94	1.02	1.01	1.05	1.11	1.07	1.06	1.30
South Dakota	--------	--------	--------	--------	--------	1.96	1.73	1.55	2.03
Tennessee	1 15	1.09	1.11	1.12	1.14	1.14	1.14	1.13	1.23
Texas	1.80	1.72	1.67	1.66	1.67	1.77	1.69	1.65	1.56
Utah	1.69	1.66	1.68	1.69	1.67	1.65	1.59	1.58	1.62
Virginia	.91	.89	.90	.91	.96	1.01	1.01	.98	1.06
Washington	2.21	2.54	2.50	2.29	2.39	2.38	2.20	2.17	2.27
West Virginia	.95	.86	.92	.90	.94	1.01	.99	.97	1.18
Wyoming	1.62	1.55	1.55	1.56	1.58	1.56	1.55	1.46	1.55
Total bituminous	1.12	1.07	1.12	1.11	1.15	1.18	1.17	1.13	1.32
Pennsylvania anthracite [g]	1.90	1.84	1.90	1.94	2.11	2.13	2.07	2.07	2.30

State	1917	1918	1919	1920	1921	1922	1923	1924	
								Average	Increase or decrease
Alabama	$2.27	$2.85	$2.96	$3.65	$3.08	$2.34	$2.52	$2.34	−$0.18
Alaska	4.92	5.45	5.66	5.83	6.46	5.43	6.30	5.62	−.68
Arkansas	2.56	3.67	3.70	4.56	4.37	4.14	4.01	4.06	+.05
California	[c]2.30	[c]2.70	[c]3.38	[c]4.36	[c]4.66	[c]3.87	[c]3.94	[c]4.19	+.25
Colorado	2.22	2.69	2.78	3.49	3.55	3.16	3.22	3.05	−.17
Georgia	2.53	3.59	3.71	5.00	2.14	4.06	4.32	3.62	−.70
Idaho	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Illinois	1.88	2.32	2.30	3.08	2.74	2.89	2.50	2.27	−.23
Indiana	1.99	2.29	2.22	3.16	2.57	2.85	2.48	2.16	−.32
Iowa	2.35	3.02	3.09	3.94	3.81	3.72	3.59	3.31	−.28
Kansas	2.31	2.91	3.05	3.87	3.85	3.66	3.21	3.03	−.18
Kentucky	2.17	2.55	2.46	4.11	2.69	3.02	2.54	1.88	−.66
Maryland	2.46	2.77	2.73	4.63	3.61	3.37	3.02	2.17	−.85
Michigan	3.22	3.83	3.88	4.93	4.87	5.05	4.73	4.33	−.40
Missouri	2.43	3.02	3.21	4.16	3.92	3.81	3.40	3.29	−.11
Montana	2.11	2.53	2.67	3.16	3.26	3.19	3.07	2.96	−.11
New Mexico	1.86	2.68	3.11	3.68	3.91	3.49	3.66	3.51	−.15
North Carolina	--------	4.75	3.84	7.02	5.76	4.94	3.66	3.92	+.26
North Dakota	1.80	2.45	2.50	2.87	2.69	2.65	2.36	2.06	−.30
Ohio	2.48	2.58	2.22	3.82	2.65	3.23	2.43	2.03	−.40
Oklahoma	2.81	3.64	3.83	4.80	4.62	4.11	3.77	3.69	−.08
Oregon	3.38	2.81	3.40	4.49	(a)	(a)	(a)	(a)	(a)
Pennsylvania (bituminous)	2.44	2.59	2.42	3.77	2.78	3.11	2.75	2.26	−.49
South Dakota	2.90	2.80	3.17	3.60	2.81	2.84	2.41	2.99	+.58
Tennessee	2.19	2.83	2.77	4.02	3.35	2.89	2.73	2.13	−.60
Texas	1.77	2.63	2.69	3.75	2.64	2.32	1.82	1.50	−.32
Utah	2.07	2.71	2.76	3.22	3.35	3.14	2.89	2.69	−.20
Virginia	2.00	2.51	2.55	3.99	3.06	2.58	2.76	2.04	−.72
Washington	2.68	3.46	3.58	3.88	4.03	3.98	3.72	3.65	−.07
West Virginia	2.32	2.56	2.49	4.34	2.84	2.93	2.65	1.82	−.83
Wyoming	1.93	2.39	2.60	2.98	3.24	3.04	2.76	2.71	−.05
Total bituminous	2.26	2.58	2.49	3.75	2.89	3.02	2.68	2.20	−.48
Pennsylvania anthracite [g]	2.85	3.40	4.14	4.85	5.00	5.01	5.43	5.43	--------

[a] Included with California.

[b] California includes Alaska.

[c] California includes Alaska, Idaho, and Nevada in 1913, 1914, and 1915; Idaho in 1916, 1917, 1918, 1919, and 1920; Idaho and Oregon in 1921, 1922, and 1923; and Idaho, Nebraska, and Oregon in 1924.

[d] Georgia includes North Carolina.

[e] Average for total output, including refuse from washery. The average, excluding refuse, was $1.71.

[f] Idaho includes Nevada.

[g] These values represent amounts per net ton and include all coal produced.

TABLE 55.—*Average value per net ton of bituminous coal exported from the United States to Canada and to all other destinations, by months, 1919–1924*

[Computed from records of Bureau of Foreign and Domestic Commerce. Figures represent value at port, including transportation, and are therefore affected by changes in freight rates as well as f. o. b. mine prices. They include, of course, both spot and contract shipments. Data for 1902 to 1918 were published in Mineral Resources, 1923, Part II, p. 624]

Month	1919		1920		1921	
	Canada	Overseas and all others	Canada	Overseas and all others	Canada	Overseas and all others
January	$3.32	$5.69	$3.77	$5.72	$5.73	$7.95
February	3.28	5.60	3.77	5.83	5.39	7.38
March	3.87	5.52	3.78	5.97	5.29	7.09
April	3.82	5.05	4.02	6.55	4.71	6.60
May	3.33	5.07	4.13	7.29	4.39	6.19
June	3.23	4.93	4.69	8.62	3.94	5.91
July	3.22	4.94	5.56	10.84	3.98	6.21
August	3.28	5.24	5.95	12.01	3.98	6.16
September	3.32	5.45	6.00	11.82	4.12	6.43
October	3.34	5.62	6.06	12.20	4.06	6.01
November	3.58	5.69	5.90	11.12	4.31	5.75
December	3.52	5.56	5.83	9.28	4.13	5.75
Average	3.35	5.35	5.36	9.75	4.42	6.51

Month	1922		1923		1924	
January	$4.34	$5.83	$5.61	$6.00	$4.73	$4.55
February	4.74	5.48	5.80	5.96	4.64	4.49
March	4.68	5.05	5.77	5.75	4.52	4.45
April	4.03	4.88	5.38	5.98	4.40	4.41
May	4.01	4.83	4.70	5.78	4.01	4.47
June	4.55	5.73	4.51	5.18	3.66	4.46
July	4.79	5.33	4.40	5.10	3.68	4.48
August	6.09	5.69	4.35	4.92	3.83	4.37
September	5.99	5.93	4.50	5.04	3.76	4.19
October	5.56	6.22	4.47	4.69	3.91	4.24
November	5.78	5.69	4.39	4.59	4.17	4.32
December	5.72	5.92	4.59	4.45	4.16	4.27
Average	5.30	5.39	4.76	5.30	4.06	4.40

SPOT PRICES

TABLE 56.—*Average spot price and average amount received per ton for bituminous coal, 1906–1924*

Year	Coal Age's average spot price	Average amount received	Difference	Year	Coal Age's average spot price	Average amount received	Difference
1906	$1.21	$1.11	+$0.10	1917	$3.25	$2.26	+$0.99
1907	1.18	1.14	+.04	1918	2.58	2.58	--------
1908	1.05	1.12	−.07	1919	2.59	2.49	+.10
1909	1.04	1.07	−.03	1920	5.64	3.75	+1.89
1910	1.23	1.12	+.11	1921	2.55	2.89	−.34
1911	1.07	1.11	−.04	1922	3.64	3.02	+.62
1912	1.21	1.15	+.06	1923	2.77	2.68	+.09
1913	1.23	1.18	+.05	1924	2.08	2.20	−.12
1914	1.14	1.17	−.03				
1915	1.12	1.13	−.01	Average, 19 years	2.02	1.82	+.20
1916	1.85	1.32	+.53				

TABLE 57.—*Monthly average spot price of bituminous coal f. o. b. mines, 1906–1924, as published by Coal Age*

[Figures are average of trade-journal quotations on 14 coals representative of nearly 90 per cent of the bituminous output of the United States, weighted, first, with respect to the proportions each of slack, prepared, and run of mine normally shipped and, second, with respect to the tonnage of each normally produced. For 1919 to 1924 the figures are those published currently by Coal Age, based upon the reports of its field correspondents. For 1913 to 1918 they are taken from Prices of Coal and Coke, by C. E. Lesher, published in 1919 as a chapter of Mineral Resources of the United States, 1918, and also separately by the Fuel Administration and the War Industries Board, modified slightly, however, to permit comparison with the postwar quotations. For 1906 to 1912 they are taken from a study by F. G. Tryon and W. F. McKenney, compiled in as nearly the same way as the trade-journal quotations available permit, and representing 12 or 14 coals covered by the later series]

Month	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915
January	$1.10	$1.28	$1.09	$1.06	$1.24	$1.16	$1.14	$1.46	$1.21	$1.13
February	1.09	1.21	1.07	1.05	1.23	1.11	1.22	1.22	1.16	1.12
March	1.27	1.14	1.05	1.04	1.25	1.08	1.64	1.17	1.17	1.09
April	1.46	1.12	1.05	1.05	1.26	1.06	1.30	1.17	1.16	1.08
May	1.21	1.11	1.03	1.03	1.19	1.05	1.11	1.15	1.16	1.07
June	1.14	1.10	1.03	1.02	1.18	1.05	1.09	1.14	1.12	1.07
July	1.06	1.10	1.02	1.00	1.18	1.03	1.04	1.18	1.12	1.05
August	1.11	1.13	1.04	1.00	1.20	1.02	1.05	1.22	1.13	1.07
September	1.15	1.20	1.06	1.01	1.32	1.03	1.09	1.23	1.11	1.10
October	1.29	1.30	1.05	1.04	1.27	1.04	1.21	1.29	1.13	1.12
November	1.30	1.29	1.05	1.09	1.23	1.09	1.30	1.31	1.10	1.17
December	1.32	1.15	1.04	1.09	1.22	1.09	1.29	1.26	1.11	1.33
Average	1.21	1.18	1.05	1.04	1.23	1.07	1.21	1.23	1.14	1.12

Month	1916	1917	1918	1919	1920	1921	1922	1923	1924
January	$1.53	$4.15	$2.48	$2.57	$2.57	$3.26	$2.25	$4.38	$2.21
February	1.40	4.18	2.53	2.49	2.58	2.77	2.20	3.59	2.25
March	1.27	3.89	2.58	2.47	2.58	2.63	2.12	3.20	2.15
April	1.24	3.21	2.64	2.43	3.85	2.62	2.24	2.84	2.07
May	1.21	4.14	2.67	2.38	4.59	2.68	3.11	2.68	2.04
June	1.26	4.00	2.57	2.40	7.18	2.52	3.31	2.56	2.03
July	1.22	3.17	2.58	2.47	8.24	2.40	4.67	2.40	1.98
August	1.30	3.24	2.58	2.76	9.51	2.42	6.13	2.39	1.99
September	1.57	2.02	2.58	2.91	8.52	2.37	5.08	2.46	2.02
October	2.26	2.02	2.58	3.09	7.78	2.33	4.48	2.28	2.10
November	3.87	2.48	2.58	2.57	5.87	2.35	4.11	2.25	2.06
December	4.01	2.48	2.58	2.58	4.38	2.26	4.05	2.18	2.06
Average	1.85	3.25	2.58	2.59	5.64	2.55	3.64	2.77	2.08

Table 58.—*Average spot prices of bituminous coal f. o. b. mines in certain States, 1918–1924, as published in Coal Age*

State	Annual average						Monthly averages, 1924											
	1918	1919	1920	1921	1922	1923	January	February	March	April	May	June	July	August	September	October	November	December
Alabama: Steam coal, run of mine	([a])	$2.64	$5.12	$2.63	$2.42	$2.07	$1.88	$1.80	$1.88	$2.00	$2.00	$1.94	$1.77	$1.75	$1.70	$1.63	$1.68	$1.70
Illinois:																		
Central, run of mine	$2.29	2.31	4.23	2.36	3.14	2.33	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.15	2.20	2.20	2.20	2.20
Southern, run of mine	2.31	2.42	4.18	3.01	3.55	3.07	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38	2.38
Standard, run of mine	2.27	2.02	3.94	1.90	2.53	2.04	1.95	1.95	1.95	1.95	1.93	1.80	1.80	1.80	1.80	2.00	1.95	1.95
Indiana, fourth and fifth vein:																		
Lump	([a])	2.71	4.52	3.09	4.00	3.31	2.87	2.87	2.75	2.63	2.60	2.62	2.50	2.58	2.77	3.00	2.98	3.01
Run of mine	2.28	2.45	3.98	2.63	3.33	2.57	2.38	2.37	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
Screenings	([a])	2.09	3.68	1.83	2.66	1.63	1.74	1.59	1.77	1.86	1.86	1.77	1.59	1.65	1.47	1.23	1.28	1.54
Kentucky:																		
Eastern, run of mine	2.89	2.80	6.21	2.47	3.46	2.27	1.77	1.86	1.67	1.51	1.50	1.53	1.51	1.54	1.55	1.60	1.57	1.51
Western, run of mine	2.20	2.30	4.22	2.24	3.25	1.92	1.59	1.66	1.51	1.62	1.63	1.57	1.63	1.61	1.64	1.67	1.62	1.56
Ohio:																		
Pittsburgh No. 8, run of mine	2.44	2.22	5.82	2.28	3.57	2.32	1.91	1.88	1.83	1.81	1.89	1.87	1.86	1.84	1.84	1.88	1.84	1.88
Hocking, run of mine	2.51	2.29	4.67	2.17	3.32	2.11	1.85	1.88	1.81	1.64	1.63	1.72	1.72	1.55	1.57	1.61	1.61	1.63
Pennsylvania:																		
Somerset, run of mine	2.84	3.08	6.60	2.64	3.51	3.01	2.11	2.25	2.26	2.23	2.22	2.18	2.03	2.11	2.08	2.09	2.09	2.13
Clearfield, run of mine	2.84	2.62	6.96	2.24	3.59	2.72	1.91	1.99	2.04	2.06	2.01	2.00	1.86	1.88	1.90	1.97	1.92	2.00
Pittsburgh, run of mine	2.36	2.11	5.72	2.25	2.78	2.27	2.00	2.06	2.13	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.88
West Virginia:																		
Smokeless, run of mine	2.42	2.93	7.23	2.52	3.52	3.51	2.14	2.27	2.07	2.02	1.97	1.98	1.89	1.84	1.83	2.05	1.89	1.79
Kanawha, run of mine	2.53	2.78	5.06	2.20	3.42	2.19	1.66	1.72	1.50	1.44	1.39	1.48	1.49	1.44	1.40	1.45	1.48	1.49

[a] No data

BITUMINOUS COAL LOADED FOR SHIPMENT

TABLE 59.—*Bituminous coal loaded for shipment, by railroads and waterways, 1924, in net tons*

Route	State	Quantity	
		By State	Total for route
RAILROADS			
Akron, Canton & Youngstown	Ohio	25,397	25,397
Alabama Central	Alabama	105,993	105,993
Alabama Great Southern	do	243,269	243,269
Alaska	Alaska	93,932	93,932
Alton & Southern	Illinois	41,865	41,865
Arkansas Western	Arkansas	54	54
Ashland Coal & Iron Co	Kentucky	96,447	96,447
Atchison, Topeka & Santa Fe	Colorado	669,565	4,216,936
	Illinois	409,169	
	Kansas	922,552	
	Missouri	395,189	
	New Mexico	1,735,104	
	Oklahoma	85,357	
Atlanta, Birmingham & Atlantic	Alabama	35,697	35,697
Atlantic & Yadkin	North Carolina	920	920
Baltimore & Ohio	Illinois	1,334,845	34,067,822
	Indiana	207,683	
	Kentucky	15,642	
	Maryland	35,302	
	Ohio	8,926,692	
	Pennsylvania	8,359,974	
	West Virginia	15,187,684	
Bessemer & Lake Erie	Pennsylvania	2,306,235	2,306,235
Bevier & Southern	Missouri	97,455	97,455
Big Sandy & Cumberland	Kentucky	12,153	12,153
Big Sandy & Kentucky River	do	61,026	61,026
Buffalo & Susquehanna	Pennsylvania	1,075,837	1,075,837
Buffalo Creek & Gauley	West Virginia	643,114	643,114
Buffalo, Rochester & Pittsburgh	Pennsylvania	4,728,720	4,728,720
Cambria & Indiana	do	2,622,967	2,622,967
Campbell's Creek	West Virginia	224,516	224,516
Carbon County	Utah	212,213	212,213
Caseyville	Illinois	25,575	25,575
Central Indiana	Indiana	8,162	8,162
Central of Georgia	Alabama	966,015	1,024,112
	Georgia	58,097	
Chattanooga & Montlake	Tennessee	12,700	12,700
Cheat Haven & Bruceton	West Virginia	58,081	58,081
Chesapeake & Ohio	Kentucky	5,282,819	38,450,990
	West Virginia	33,168,171	
Cheswick & Harmar	Pennsylvania	259,499	259,499
Chicago & Alton	Illinois	3,697,910	3,753,885
	Missouri	55,975	
Chicago & Eastern Illinois	Illinois	4,637,339	8,489,922
	Indiana	3,852,583	
Chicago & Illinois Midland	Illinois	2,515,641	2,515,641
Chicago & Northwestern	do	3,292,318	4,088,171
	Iowa	701,978	
	Wyoming	93,875	
Chicago, Burlington & Quincy	Colorado	512,056	13,903,941
	Illinois	11,436,678	
	Iowa	384,768	
	Missouri	170,989	
	Nebraska	60	
	Wyoming	1,399,390	
Chicago, Indianapolis & Louisville	Indiana	1,549,100	1,549,100
Chicago, Milwaukee & St. Paul	Illinois	417,769	8,574,390
	Indiana	6,205,195	
	Iowa	832,985	
	Missouri	80,919	
	Montana	946,847	
	North Dakota	76,098	
	South Dakota	3,000	
	Washington	11,577	
Chicago, Peoria & St. Louis	Illinois	316,332	316,332
Chicago, Rock Island & Gulf	Texas	15,684	15,684
Chicago, Rock Island & Pacific	Colorado	46,723	2,173,898
	Illinois	61,985	
	Iowa	1,408,090	
	Missouri	19,741	
	Oklahoma	637,359	

TABLE 59.—*Bituminous coal loaded for shipment, by railroads and waterways, 1924, in net tons*—Continued

Route	State	Quantity	
		By State	Total for route
RAILROADS—continued			
Cincinnati, Indianapolis & Western	Illinois	44,005	181,699
	Indiana	137,694	
Cincinnati, New Orleans & Texas Pacific	Tennessee	58,894	58,894
Cleveland, Cincinnati, Chicago & St. Louis	Illinois	6,641,667	7,387,242
	Indiana	745,575	
Clinchfield	Kentucky	51,685	2,201,077
	Virginia	2,149,392	
Colfax Northern	Iowa	76,339	76,339
Colorado & Southeastern	Colorado	389,304	389,304
Colorado & Southern	do	2,425,146	2,425,146
Colorado & Wyoming	do	234,650	234,650
Crystal River & San Juan	do	2,520	2,520
Cumberland	Kentucky	56,646	56,646
Cumberland & Manchester	do	184,767	184,767
Cumberland & Pennsylvania	Maryland	1,019,631	1,019,631
Dardenelle & Russellville	Arkansas	59,378	59,378
Dent's Run	Pennsylvania	24,846	24,846
Denver & Intermountain	Colorado	112,723	112,723
Denver & Rio Grande Western	do	2,945,469	5,350,167
	New Mexico	31,020	
	Utah	2,373,678	
Denver & Salt Lake	Colorado	850,115	850,115
Des Moines & Central Iowa	Iowa	174,876	174,876
Detroit, Toledo & Ironton	Ohio	40,077	40,077
East Broad Top R. R. & Coal Co	Pennsylvania	720,379	720,379
Eastern Kentucky	Kentucky	5,538	5,538
Eastern Railway & Lumber Co	Washington	16,827	16,827
East St. Louis & Suburban	Illinois	128,093	128,093
Elgin, Joliet & Eastern	do	141,061	141,061
El Paso & Southwestern	New Mexico	703,798	703,798
Erbacon & Summerville	West Virginia	360	360
Erie	Ohio	65,908	1,784,062
	Pennsylvania	1,718,154	
Evansville & Ohio Valley	Indiana	66,856	66,856
Evansville, Indianapolis & Terre Haute	do	1,930,777	1,930,777
Evansville, Suburban & Newburgh	do	66,483	66,483
Federal Valley	Ohio	51,109	51,109
Fort Dodge, Des Moines & Southern	Iowa	38,992	38,992
Fort Smith & Western	Oklahoma	34,965	34,965
Fort Smith, Subiaco & Rock Island	Arkansas	1,130	1,130
Galveston, Harrisburg & San Antonio	Texas	17,865	17,865
Grand Prairie Branch	Arkansas	46,092	46,092
Great Northern	Montana	521,600	1,038,375
	North Dakota	331,707	
	Washington	185,068	
Greenbrier & Eastern	West Virginia	973,854	973,854
Harriman & Northeastern	Tennessee	181,824	181,824
Hartland	West Virginia	74,694	74,694
Hocking Sunday Creek Traction	Ohio	4,815	4,815
Hocking Valley	do	1,606,572	1,606,572
Houston & Texas Central	Texas	122,082	122,082
Houston East & West Texas	do	63,190	63,190
Huntingdon & Broad Top Mountain	Pennsylvania	341,082	341,082
Illinois Central	Alabama	166,656	16,739,971
	Illinois	11,929,589	
	Indiana	329,752	
	Kentucky	4,313,974	
Illinois Terminal	Illinois	33,799	33,799
Illinois Traction	do	830,379	830,379
Indiana County Street Railway	Pennsylvania	1,709	1,709
Indian Creek Valley	do	507,723	507,723
International & Great Northern	Texas	195,743	195,743
Interstate	Kentucky	122,632	2,397,411
	Virginia	2,274,779	
Iowa Southern Utilities Co	Iowa	76,421	76,421
Jefferson Southwestern	Illinois	131,603	131,603
Johnstown & Stony Creek	Pennsylvania	149,461	149,461
Joplin & Pittsburg	Kansas	42,416	42,416
Kanawha & Michigan	Ohio	312,935	451,481
	West Virginia	138,546	
Kanawha & West Virginia	do	30,421	30,421
Kanawha Central	do	113,448	113,448
Kanawha, Glen Jean & Eastern	do	778,063	778,063
Kansas City, Clay County & St. Joseph	Missouri	1,135	1,135
Kansas City, Clinton & Springfield	do	1,100	1,100

TABLE 59.—*Bituminous coal loaded for shipment, by railroads and waterways, 1924, in net tons*—Continued

Route	State	Quantity	
		By State	Total for route
RAILROADS—continued			
Kansas City Southern	Kansas	357,294	704,114
	Missouri	282,053	
	Oklahoma	64,767	
Kansas, Oklahoma & Gulf	do	232,490	232,490
Kentucky & Tennessee	Kentucky	760,881	760,881
Lake Erie, Franklin & Clarion	Pennsylvania	636,179	636,179
Laramie, North Park & Western	Colorado	61,080	61,080
Lenox	Kentucky	5,163	5,163
Ligonier Valley	Pennsylvania	408,471	408,471
Litchfield & Madison	Illinois	965,990	965,990
Long Fork	Kentucky	639,411	639,411
Louisiana Railway & Navigation Co. of Texas	Texas	35,338	35,338
Louisville & Nashville	Alabama	4,189,306	30,426,227
	Illinois	483,412	
	Kentucky	24,835,868	
	Tennessee	752,420	
	Virginia	165,221	
Louisville, Henderson & St. Louis	Kentucky	136,309	136,309
Marion & Eastern	Illinois	319	319
Mary Lee	Alabama	112,835	112,835
Michigan Central	Michigan	453,437	453,437
Midland Valley	Arkansas	257,518	367,358
	Oklahoma	109,840	
Millers Creek	Kentucky	446,124	446,124
Minneapolis & St. Louis	Illinois	573,867	873,762
	Iowa	299,895	
Minneapolis, St. Paul & Sault Ste. Marie	North Dakota	165,004	165,004
Missouri-Illinois	Illinois	472,168	472,168
Missouri, Kansas & Texas	Kansas	79,070	677,298
	Missouri	68,121	
	Oklahoma	349,500	
	Texas	180,607	
Missouri Pacific	Arkansas	714,788	6,789,841
	Illinois	4,426,364	
	Kansas	1,096,643	
	Missouri	539,416	
	Oklahoma	12,630	
Mobile & Ohio	Alabama	695,163	1,218,730
	Illinois	523,567	
Monongahela	Pennsylvania	3,640,967	7,957,372
	West Virginia	4,316,405	
Montana	Arkansas	86,822	86,822
Montana, Wyoming & Southern	Montana	441,864	441,864
Montour	Pennsylvania	4,880,775	4,880,775
Morehead & North Fork	Kentucky	927	927
Morgan & Fentress	Tennessee	39,215	39,215
Morgantown & Kingwood	West Virginia	42,708	42,708
Nashville, Chattanooga & St. Louis	Alabama	432	746,094
	Tennessee	745,662	
New Mexico Midland	New Mexico	77,716	77,716
New York Central	Ohio	2,393,106	8,898,308
	Pennsylvania	5,727,335	
	West Virginia	777,867	
New York, Chicago & St. Louis	Illinois	483,626	487,244
	Indiana	3,618	
Norfolk & Western	Kentucky	3,838,523	32,526,198
	Virginia	2,784,026	
	West Virginia	25,903,649	
Norfolk Southern	North Carolina	50,174	50,174
Northern Alabama	Alabama	464,091	464,091
Northern Pacific	Montana	740,525	2,627,669
	North Dakota	385,178	
	Washington	1,501,966	
Norton & Northern	Virginia	102,058	102,058
Ohio & Kentucky	Kentucky	16,618	16,618
Ohio River Electric Railway & Power Co	Ohio	394	394
Oregon Short Line	Idaho	5,000	1,268,073
	Wyoming	1,263,073	
Oregon-Washington Railroad & Navigation Co	Washington	260,148	260,148
Pacific Coast	do	454,302	454,302
Pennsylvania (includes Ohio River & Western, and Pittsburgh, Cincinnati, Chicago, & St. Louis)	Illinois	1,057,292	58,321,875
	Indiana	3,776,213	
	Ohio	6,451,707	
	Pennsylvania	46,045,964	
	West Virginia	990,699	

TABLE 59.—*Bituminous coal loaded for shipment, by railroads and waterways, 1924, in net tons*—Continued

Route	State	Quantity	
		By State	Total for route
RAILROADS—continued			
Peoria & Pekin Union	Illinois	609, 575	609, 575
Peoria, Hanna City & Western	do	380, 216	380, 216
Pere Marquette	Michigan	313, 922	313, 922
Peru, La Salle & Deer Park	Illinois	50, 726	50, 726
Pittsburgh & Lake Erie	Pennsylvania	3, 878, 616	3, 878, 616
Pittsburgh & Shawmut	do	1, 499, 711	1, 499, 711
Pittsburgh & Susquchanna	do	71, 631	71, 631
Pittsburgh & West Virginia	Ohio	448, 544	2, 050, 751
	Pennsylvania	1, 425, 740	
	West Virginia	176, 467	
Pittsburgh, Chartiers & Youghiogheny	Pennsylvania	536, 245	536, 245
Pittsburg County Railway Co	Oklahoma	30, 050	30, 050
Pittsburgh, Harmony, Butler & Newcastle	Pennsylvania	24, 423	24, 423
Pittsburgh, Lisbon & Western	Ohio	1, 030	175, 892
	Pennsylvania	174, 862	
Pittsburgh, Shawmut & Northern	do	483, 052	483, 052
Preston	Maryland	671	68, 627
	West Virginia	67, 956	
Puget Sound Electric	Washington	12, 171	12, 171
Quincy, Omaha & Kansas City	Missouri	35, 532	35, 532
Richwood & Gauley	West Virginia	43, 931	43, 931
Rio Grande & Eagle Pass	Texas	30, 327	30, 327
Rio Grande Southern	Colorado	49, 297	49, 297
Rockcastle River	Kentucky	3, 000	3, 000
Rockdale, Sandow & Southern	Texas	110, 339	110, 339
Rock Island Southern	Illinois	99, 126	99, 126
St. Louis & Belleville Electric	do	173, 584	173, 584
St. Louis & Hannibal	Missouri	6, 961	6, 961
St. Louis & O'Fallon	Illinois	543, 806	543, 806
St. Louis & Ohio River	do	158, 381	158, 381
St. Louis-San Francisco	Alabama	2, 483, 258	5, 089, 368
	Arkansas	237, 147	
	Kansas	1, 359, 254	
	Missouri	329, 730	
	Oklahoma	679, 979	
St. Louis Southwestern of Texas	Texas	213, 763	213, 763
St. Louis, Troy & Eastern	Illinois	823, 045	823, 045
San Antonio & Aransas Pass	Texas	14, 210	14, 210
San Antonio Southern	do	14, 667	14, 667
Sandy Valley & Elkhorn	Kentucky	1, 727, 060	1, 727, 060
Santa Fe, Raton & Eastern	New Mexico	1, 800	1, 800
Scotts Run	West Virginia	2, 469, 188	2, 469, 188
Seaboard Air Line	Alabama	6, 122	6, 122
Sewell Valley	West Virginia	130, 009	130, 009
Southern	Alabama	3, 940, 269	10, 488, 989
	Illinois	750, 240	
	Indiana	1, 458, 725	
	Kentucky	538, 998	
	Tennessee	1, 527, 027	
	Virginia	2, 273, 730	
Southern Pacific	Oregon	3, 292	3, 292
Springfield Terminal	Illinois	183, 448	183, 448
Strouds Creek & Muddlety	West Virginia	79, 578	79, 578
Susquehanna & New York	Pennsylvania	3, 413	3, 413
Tennessee	Tennessee	424, 921	424, 921
Tennessee Central	do	382, 210	382, 210
Tennessee Coal, Iron & R. R. Co	Alabama	3, 508, 374	3, 508, 374
Texas & Pacific	Texas	87, 842	87, 842
Texas Short Line	do	17, 391	17, 391
Thomas & Sayreton	Alabama	467, 601	467, 601
Toledo & Ohio Central	Ohio	1, 633, 337	1, 633, 337
Toledo, Peoria & Western	Illinois	169, 749	169, 749
Uintah	Colorado	10, 048	10, 048
Union	Pennsylvania	350, 022	350, 022
Union Pacific	Colorado	1, 203, 838	4, 950, 535
	Kansas	13, 896	
	Utah	41, 832	
	Wyoming	3, 690, 969	
Unity	Pennsylvania	546, 654	546, 654
Ursina & North Fork	do	16, 477	16, 477
Utah	Utah	1, 479, 538	1, 479, 538
Virginian	Virginia	6, 956	7, 804, 506
	West Virginia	7, 797, 550	

TABLE 59.—*Bituminous coal loaded for shipment, by railroads and waterways, 1924, in net tons*—Continued

Route	State	Quantity	
		By State	Total for route
RAILROADS—continued			
Wabash	Illinois	2,660,081	3,101,828
	Iowa	356,908	
	Missouri	84,839	
Wabash, Chester & Western	Illinois	19,261	19,261
Washington Run	Pennsylvania	100,764	100,764
Western Allegheny	do	309,607	309,607
Western Maryland	Maryland	889,655	3,564,715
	Pennsylvania	475,640	
	West Virginia	2,199,420	
West Side Belt	Pennsylvania	1,627,688	1,627,688
West Virginia Northern	West Virginia	425,654	425,654
Wheeling & Lake Erie	Ohio	4,256,458	4,256,458
Woodward Iron Co	Alabama	915,228	915,228
Youngstown & Ohio River	Ohio	119,251	119,251
Zanesville & Western	do	968,906	968,906
Total railroad shipments		425,891,490	425,891,490
WATERWAYS			
Allegheny River	Pennsylvania	423,643	423,643
Black Warrior River	Alabama	94,785	94,785
Great Kanawha River	West Virginia	242,182	242,182
Green River	Kentucky	62,830	62,830
Illinois River	Illinois	14,455	14,555
Kentucky River	Kentucky	35,000	35,000
Monongahela River	Pennsylvania	14,134,636	14,134,636
Muskingum River	Ohio	6,000	6,000
Ohio River	Kentucky	433,141	642,673
	Ohio	92,713	
	Pennsylvania	1,720	
	West Virginia	115,099	
Tennessee River	Tennessee	18,000	18,000
Total waterway shipments		15,674,204	15,674,204
Grand total railroads and waterways		441,565,694	441,565,694

STOCKS OF COAL HELD BY CONSUMERS

TABLE 60.—*Stocks of bituminous coal in hands of commercial consumers and stocks of anthracite and bituminous coal in retail dealers' yards, 1916–1924*

[From periodic stock reports of the U. S. Geological Survey. Coal for steamship fuel, on lake docks, in transit, and in the bins of householders is not included]

Date	Total stock estimated (tons)[a]	Day's supply at current rate of consumption on date of stock taking								
		By-product coke plants	Steel plants	Other industrials	Coal gas plants	Electric utilities	Coal dealers, bituminous	Railroads	Total bituminous	Anthracite in retail yards
1916—Oct. 1	27,000,000	(b)	25		(b)	(b)	(b)	20	(c)	(b)
1917—Oct. 1	28,100,000	(b)	27		(b)	(b)	(b)	18	(d)	(b)
1918—July 15	39,700,000	28	27	48	72	39	15	25	31	(b)
Oct. 1	59,000,000	32	45	71	84	47	28	29	43	(b)
Armistice Day (Nov. 11)	63,000,000	35	45	71	85	49	37	31	45	(b)
1919—Jan. 1	57,900,000	32	42	65	81	49	39	32	42	36
Apr. 1	40,400,000	23	35	47	58	48	25	(b)	31	31
1920—Mar. 1	24,000,000	15	9	27	31	21	13	11	18	21
June 1	20,000,000	8	11	24	22	22	10	10	15	15
1921—Jan. 1	45,800,000	29	42	64	55	44	30	23	39	24
Apr. 1	39,500,000	28	38	47	66	48	26	24	36	36
Aug. 1	41,000,000	31	46	56	79	44	42	32	39	50
Nov. 1	48,500,000	38	46	67	87	54	46	31	43	47
1922—Jan. 1	48,000,000	42	48	51	89	51	33	35	41	44
Mar. 1	52,500,000	39	48	56	82	54	23	42	43	28
Apr. 1	[e] 63,000,000	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)
Sept. 1	22,000,000	11	12	32	34	26	11	13	17	5
Oct. 1	26,000,000	14	17	33	38	30	18	15	21	7
Nov. 1	32,000,000	18	21	39	55	32	21	13	23	11
1923—Jan. 1	36,000,000	19	27	40	60	33	18	16	26	11
Feb. 1	38,000,000	20	26	36	62	35	15	18	24	8
Mar. 1	36,000,000	19	26	34	58	34	11	16	22	6
June 1	42,000,000	23	29	39	75	45	27	21	30	19
July 1	46,000,000	26	35	46	89	48	39	28	37	25
Aug. 1	52,000,000	27	35	54	104	52	45	39	44	25
Sept. 1	56,000,000	30	33	56	110	52	38	44	46	21
Oct. 1	60,000,000	33	39	56	91	49	36	41	45	22
1924—Jan. 1	62,000,000	35	43	55	91	51	34	44	46	37
June 1	51,000,000	34	56	53	88	63	40	50	49	49
Sept. 1	47,000,000	30	42	48	90	58	46	42	45	58
Dec. 31	[e] 45,000,000	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)

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[a] The figures for 1918 in this table are based upon an actual count. Beginning with Apr. 1, 1919, the figures are based upon reports from a selected list of 5,000 consumers whose stocks in 1918 bore a known relation to the known total stocks.

[b] No data.

[c] Data incomplete. Estimated as 22 days.

[d] Data incomplete. Estimated as 21 days.

[e] No canvass of consumers was made on this date. The total was estimated from stocks reported in the preceding canvass.

IMPORTS AND EXPORTS[1]

TABLE 61.—*Bituminous coal imported, by countries and districts, 1920-1924, in net tons*

[Compiled from the records of the Bureau of Foreign and Domestic Commerce]

Country and district	1920	1921	1922	1923	1924
COUNTRY OF ORIGIN					
North America:					
Canada	1,123,903	1,092,132	1,555,038	1,099,773	317,184
Mexico	48	115	147	9	26
Newfoundland and Labrador	1,240	----------	----------	----------	----------
Cuba	----------	----------	325	133	----------
Dutch West Indies	----------	221	----------	----------	----------
South America:					
Brazil	67	123	20	----------	----------
Venezuela	----------	2	129	728	----------
Europe:					
Belgium	55	1	1,680	504	----------
France	33	875	----------	9	348
Germany	314	225	2,894	538	----------
Greece	280	----------	----------	----------	----------
Italy	----------	1	----------	----------	----------
Netherlands	84	----------	----------	----------	----------
Poland and Danzig	----------	----------	----------	1	----------
Sweden	----------	----------	44	----------	----------
United Kingdom—					
England	8,287	27,608	2,831,293	545,587	7,951
Ireland	4	----------	----------	----------	----------
Scotland	----------	1,120	457,794	97,968	20,235
Asia:					
China	3	1,667	6,588	2	146
Dutch East Indies	392	----------	----------	----------	----------
Hongkong	----------	56	----------	9,860	1
Japan	28. 408	50,191	15,428	22,496	28,923
Kwantung, leased territory	----------	8,760	----------	----------	----------
Philippine Islands	2, 240	201	1,230	280	----------
Russia in Asia	17	----------	134	----------	----------
Africa: Egypt	----------	301	----------	----------	----------
Oceania:					
Australia	76,422	73,976	187,255	89,877	39,923
New Zealand	3,193	14	----------	14,541	----------
Other Oceania	----------	----------	----------	----------	2,489
	1,244,990	1,257,589	5,059,999	1,882,306	417,226
DISTRICT OF ENTRY					
Alaska	45,264	33,776	34,251	43,204	41,980
Buffalo	4,731	17	6,579	----------	----------
Connecticut	----------	----------	4,523	----------	----------
Dakota	1,794	2,896	6,066	12,624	85
Duluth-Superior	5,357	272	17,740	371	----------
Florida	----------	28	----------	----------	134
Galveston	224	----------	2,520	----------	----------
Georgia	----------	----------	90	----------	----------
Hawaii	101,038	47,210	92,876	85,314	45,207
Los Angeles	----------	----------	28	----------	----------
Maine and New Hampshire	59,781	26,078	356,721	261,338	46,808
Maryland	448	3	89,589	572	----------
Massachusetts	6,357	301	1,645. 087	360,538	----------
Michigan	1.755	----------	2. 918	344	112
Montana-Idaho	697,174	702,707	506,179	513,465	114,676
New Orleans	----------	347	762	----------	----------
New York	16,215	1,939	1,148,142	239,369	4,561
Ohio	----------	----------	1,652	----------	----------
Oregon	4,595	4. 205	16,794	7,093	3,651
Philadelphia	----------	----------	218,361	22,515	----------
Pittsburgh	17	----------	1	1	22
Porto Rico	----------	221	129	----------	----------
Rhode Island	----------	----------	210,903	65,295	----------
St. Lawrence	2,998	317	14,597	----------	1,007
San Antonio	48	87	147	9	26
San Diego	----------	2. 240	----------	----------	----------
San Francisco	18. 567	86,902	184,880	62. 271	23,161
Vermont	1,193	9	41,096	----------	6
Virginia	1,610	----------	325	----------	----------
Wisconsin	----------	----------	1,680	----------	----------
Washington	275. 824	348,034	455,363	207,983	135,790
	1,244,990	1,257. 589	5,059,999	1,882,306	417,226

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[1] The tables of imports and exports have been compiled by J. A. Dorsey, of the Bureau of Mines, from the records of the Bureau of Foreign and Domestic Commerce.

TABLE 62.—*Anthracite imported, by countries and districts, 1920–1924, in net tons*

[Compiled from the records of the Bureau of Foreign and Domestic Commerce]

Country and district	1920	1921	1922	1923	1924
COUNTRY OF ORIGIN					
Africa:					
British—					
West			224		
South	1				
Algeria and Tunisia				168	
Australia	14		8, 427	11, 828	1, 836
Brazil		26			
British India		6			
British West Indies (other)	4				4
Canada	30, 853	6, 654	21, 220	19, 118	16, 249
Chile		1			
China			3	1, 037	
Costa Rica	2				
Dutch West Indies	112				
France		10			
Germany			901		
Japan	238	2, 174			168
Kwantung, leased territory		9			
Mexico	151			99	94
Netherlands					448
Peru	4	3	1		
Spain			34		
United Kingdom:					
England	369	11	202, 718	253, 828	99, 152
Scotland				14, 282	
	31, 748	8, 894	233, 528	300, 360	117, 951
DISTRICT OF ENTRY					
Alaska			1		
Buffalo		46		176	16
Connecticut				7, 549	
Dakota	439		311	7, 650	8, 164
Duluth-Superior	880	238	7, 940	31	38
Hawaii		2, 173			
Los Angeles				220	
Maine and New Hampshire	777	1, 259	32, 031	35, 505	22, 524
Maryland			37, 284	16, 377	8, 296
Massachusetts			32, 791	83, 988	47, 006
Michigan		39	540	571	317
Montana-Idaho	112	40		3, 609	5, 646
New Orleans			224		7
New York	627	67	74, 525	98, 048	
Oregon			3	2, 789	1, 959
Philadelphia				14, 869	
Porto Rico	117				4
Rhode Island			26, 967	17, 306	23, 110
St. Lawrence	17	35	54	67	
San Antonio	151			99	94
San Francisco			9, 547	9, 180	493
South Carolina				224	
Vermont	221	30	532	235	
Washington	28, 407	4, 967	10, 778	1, 867	277
	31, 748	8, 894	233, 528	300, 360	117, 951

TABLE 63.—*Bituminous coal exported, by countries, 1920–1924, in net tons*[a]

[Compiled from the records of the Bureau of Foreign and Domestic Commerce]

Country	1920	1921	1922	1923	1924
North America:					
Bermuda	54,939	36,738	15,968	16,936	20,206
British Honduras	493	780	1,900	1,633	429
Canada	16,230,202	13,396,774	10,836,347	16,854,257	12,654,869
Costa Rica	15,352	3,613	2,470	3,343	3,836
Guatemala	1,181	2,940	670	134	668
Honduras	14,619	15,837	6,512	1,719	2,154
Nicaragua	1,029	2,045	979	3,974	5,990
Panama	173,647	249,568	116,993	21,577	264,123
Salvador	3,502	44	34	3	72
Greenland	1,178	795	224	----------	----------
Mexico	227,598	192,876	101,983	106,006	91,507
Miquelon and St. Pierre Islands	----------	----------	----------	9,473	3,730
Newfoundland and Labrador	28,445	5,466	2,388	37,612	100,869
West Indies—					
Barbados	82,276	22,135	20,904	29,974	39,141
Jamaica	92,338	65,690	31,028	35,035	46,042
Trinidad and Tobago	31,849	22,785	19,618	23,885	28,326
Other British West Indies	53,477	8,698	13,938	24,879	19,031
Cuba	1,492,548	587,521	519,521	683,893	598,921
Dominican Republic	12,611	9,456	7,893	4,655	3,716
Dutch West Indies	45,222	13,665	32,334	60,282	60,453
French West Indies	50,916	62,520	60,474	87,367	147,338
Haiti	1	80	3	2,988	234
Virgin Islands of the United States	47,456	26,566	15,683	35,093	61,984
	18,660,879	14,726,592	11,807,864	18,044,718	14,153,639
South America:					
Argentina	1,924,712	842,952	88,448	146,793	220,058
Bolivia	----------	----------	----------	584	----------
Brazil	1,080,821	590,492	170,389	348,011	850,234
Chile	553,416	168,945	52,546	21,984	61,940
Colombia	7,076	12,867	6,325	4,542	1,556
Ecuador	4,733	4,729	4,613	2,238	3,423
Falkland Islands	3,442	----------	----------	----------	----------
Guiana—					
British	20,086	3,861	3,642	12,282	18,314
Dutch	3,244	2,757	2,129	2,659	2,913
Paraguay	7,778	----------	----------	----------	299
Peru	39,628	31,530	15,488	11,222	21,410
Uruguay	299,944	98,997	----------	32,810	68,803
Venezuela	3,164	1,724	26	2,190	2,598
	3,948,044	1,758,854	343,606	585,315	1,251,548
Europe:					
Austria	13,182	----------	----------	----------	----------
Azores and Madeira Islands	53,360	90,278	----------	----------	----------
Belgium	307,524	26,554	----------	91,280	17,164
Czechoslovakia	----------	7,529	----------	----------	----------
Denmark	1,082,647	171,307	3	----------	----------
Finland	31,229	920	----------	----------	----------
France	4,083,911	680,435	13,453	943,789	471,401
Germany	86,006	43,292	2,939	375,772	29,488
Gibraltar	92,222	141,420	----------	----------	----------
Greece	259,096	107,659	11,123	42,740	16,979
Hungary	5,817	8,292	----------	----------	----------
Iceland and Faroe Islands	8,010	15,551	----------	----------	----------
Italy	2,674,262	1,735,395	138,973	655,295	975,146
Latvia	----------	----------	----------	13,259	----------
Malta, Gozo, etc	----------	7,000	----------	----------	----------
Netherlands	2,404,581	374,180	2,841	424,397	----------
Norway	824,623	47,582	----------	2,844	----------
Poland and Danzig	7,573	----------	----------	----------	----------
Portugal	184,144	112,200	1,421	----------	----------
Rumania	9,238	2	----------	----------	----------
Russia in Europe	69,119	97,819	----------	----------	----------
Spain	73,789	65,504	----------	40,989	3,799
Sweden	1,396,730	75,107	----------	57,817	----------
Switzerland	909,812	9,810	----------	----------	----------
Turkey in Europe	105,728	21,456	----------	----------	----------

[a] Amounts stated do not include fuel or bunker coal loaded on vessels engaged in the foreign trade, which aggregated in 1920, 10,485,639 tons; in 1921, 8,453,220 tons; in 1922, 4,614,632 tons; in 1923, 5,093,024 tons; and in 1924, 4,460,412 tons.

TABLE 63.—*Bituminous coal exported, by countries, 1920–1924, in net tons*—Con.

Country	1920	1921	1922	1923	1924
Europe—Continued.					
United Kingdom—					
England	36,133	1,138,474	162	9,850	5,803
Scotland	22,100	83,324		20,116	
Ireland		454,317			
	14,740,836	5,515,407	170,915	2,678,148	1,519,780
Asia:					
Aden	17,773				
British India					1,138
China	11	7,343			4,355
Dutch East Indies	1,235	14,445			1,912
Far Eastern Republic			12		
Japan					1,978
Java and Madura					1,557
Palestine and Syria		[b] 7,595			
Philippine Islands		9,559			6,440
Russia in Asia	6	45	9		1
Turkey in Asia	13,156	19,182		2,821	
	32,181	58,169	21	2,821	17,381
Africa:					
Algeria and Tunisia			7,869	76,925	38,859
British Africa—					
West	3,979	7,439	34	1,144	6,260
South	728				
East	11,090				
Canary Islands	67,502	192,973	1,782	2,452	
Egypt	701,716	533,344	58,372	25,756	46,245
French Africa	266,735	204,746	22,622	15,710	54,905
German Africa	7,164				
Morocco		336			
Portuguese Africa	36,308	66,284			
	1,095,222	1,005,122	90,679	121,987	146,269
Oceania:					
Australia				18,533	
New Zealand	39,918	67,011		1,587	4,349
Other British Oceania	4	11			7,381
Other Oceania				470	
	39,922	67,022		20,590	11,730
Grand total	38,517,084	23,131,166	12,413,085	21,453,579	17,100,347

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[b] Figures cover period July to December, 1921.

TABLE 64.—*Bituminous coal exported, by districts and ports, 1920–1924, in net tons*

[Compiled from the records of the Bureau of Foreign and Domestic Commerce]

Customs district	Principal ocean port or rail gateway	1920	1921	1922	1923	1924
North Atlantic:						
Massachusetts	Boston	45	3,472	28	339	148
Connecticut				83		
New York	New York	283,414	69,038	8,756	16,675	33,534
Philadelphia	Philadelphia	2,756,491	687,391	140,949	339,524	164,680
Maryland	Baltimore	4,933,385	1,644,217	103,741	1,589,667	653,679
Virginia	Hampton Roads	12,755,689	6,740,444	1,124,511	2,610,243	3,632,232
South Atlantic:						
South Carolina	Charleston	741,633	336,567	136,776	262,462	135,708
Georgia	Savannah	189,185	10,258			
Florida	Pensacola	268,432	129,446	53,434	36,020	4,004
Mobile	Mobile	108,310	19,028	16,298	10,312	49,495
New Orleans	New Orleans	47,153	19,776	9,750	7,950	6,524
Galveston		217	12	210	3	
Sabine		159	56	54	34	
Mexican border:						
Arizona		38,254	26,992	22,317	40,769	41,228
El Paso		137,257	123,530	50,539	39,585	34,129
San Antonio		18,207	15,804	2,523	2,747	3,004
Pacific coast:						
Washington [a]		11,693	16,228	13,105	14,852	46,237
Oregon		392				602
San Francisco		1,185	587	5,852	2,636	157
Los Angeles		49	7		90	200
San Diego		174	180	199	32	
Lake Erie ports: Ohio [b]	Lower Lake docks	7,160,774	5,835,505	4,281,290	6,991,116	5,766,459
Lake Michigan ports: Wisconsin.				112		
Rail gateways on Canadian border:						
Eastern—						
Maine and New Hampshire.		338	244	301	11,528	4,941
Vermont		72,894	30,407	7,578	15,922	4,161
St. Lawrence		2,481,550	2,149,468	1,427,060	2,781,926	1,430,042
Rochester [c]		1,006,625	468,800	505,475	734,010	637,272
Buffalo		3,605,285	3,277,863	3,013,742	3,867,829	2,988,357
Michigan		1,782,437	1,340,509	1,400,105	1,926,314	1,284,609
Western—						
Duluth, Superior, and International Falls.		90,836	119,120	62,152	62,419	71,250
Dakota		23,715	58,517	25,950	87,984	100,900
Montana-Idaho			7,426		34	226
Miscellaneous:						
Alaska		17	50	195	293	63
Hawaii		48	11			
Porto Rico		1,241	213		264	6,506
		38,517,084	23,131,166	12,413,085	21,453,579	17,100,347

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[a] Both rail to Canada and by tide to foreign ports.

[b] Lower Lake docks as follows: Toledo, Sandusky, Huron, Lorain, Cleveland, Fairport, Ashtabula, Conneaut, and Erie.

[c] Rail, car ferry, and Lake Ontario.

TABLE 65.—*Anthracite exported, by countries, 1920–1924, in net tons*

[Compiled from the records of the Bureau of Foreign and Domestic Commerce]

Country	1920	1921	1922	1923	1924
North America:					
Bermuda	2, 119	3, 716	----------	2, 208	2, 053
British Honduras	----------	690	----------	858	42
Canada	4, 968, 282	4, 519, 216	2, 572, 450	4, 988, 837	3, 927, 999
Costa Rica	2	----------	2	2	12
Guatemala	655	110	184	137	3
Honduras	1, 397	----------	93	3	----------
Nicaragua	225	----------	100	1	4
Panama	949	1, 795	11	----------	392
Salvador	4	6	9	15	2
Mexico	18, 266	49, 820	6, 408	4, 232	3, 665
Miquelon and St. Pierre Islands	100	293	138	303	200
Newfoundland and Labrador	16, 947	17, 245	5, 903	5, 946	11, 623
West Indies—					
Barbados	685	291	151	112	316
Jamaica	109	2	22	----------	----------
Trinidad and Tobago	22	----------	----------	----------	----------
Other British West Indies	364	2, 776	416	162	174
Cuba	58, 410	53, 648	48, 748	71, 280	63, 156
Dominican Republic	7, 773	10, 531	1, 506	10, 425	5, 341
Dutch West Indies	336	444	----------	----------	1
French West Indies	13, 940	----------	----------	----------	----------
Haiti	4	1	----------	141	45
	5, 090, 589	4, 660, 584	2, 636, 141	5, 084, 662	4, 015, 028
South America:					
Argentina	5, 127	1, 959	25	84	----------
Bolivia	504	----------	----------	----------	----------
Brazil	9, 966	22	4	----------	6
Chile	1, 832	596	----------	505	6
Colombia	289	80	----------	17	38
Ecuador	964	----------	----------	55	1
Guiana—					
British	----------	----------	----------	----------	3
Dutch	----------	34	----------	----------	----------
French	----------	----------	140	----------	----------
Peru	3, 759	----------	----------	----------	560
Uruguay	90	----------	----------	----------	----------
Venezuela	6	11	9	21	24
	22, 537	2, 702	178	682	638
Europe:					
Azores and Madeira Islands	----------	30	----------	----------	----------
Belgium	8, 453	----------	----------	----------	----------
Denmark	35, 463	3, 920	9	----------	----------
Finland	822	----------	----------	----------	----------
France	73, 362	1, 594	----------	4, 787	670
Germany	352	----------	34	----------	----------
Greece	10, 662	----------	----------	3	----------
Italy	5, 468	174	----------	----------	----------
Netherlands	48, 746	1, 278	520	----------	----------
Norway	20, 595	----------	----------	----------	----------
Portugal	1, 590	----------	----------	----------	----------
Spain	----------	4, 767	----------	----------	----------
Sweden	44, 111	----------	----------	----------	----------
Switzerland	30, 754	----------	----------	----------	----------
Turkey in Europe	5, 154	----------	----------	----------	----------
England	2	368	259	4	1, 448
	285, 534	12, 131	822	4, 794	2, 118
Asia:					
Russia in Asia	----------	448	----------	----------	----------
Turkey in Asia	1, 228	101	----------	----------	----------
	1, 228	549	----------	----------	----------
Africa:					
British West Africa	----------	136	----------	----------	----------
Canary Islands	1, 105	1, 266	----------	----------	----------
Egypt	2, 747	----------	12, 314	----------	----------
Portuguese Africa	9	----------	----------	----------	----------
Oceania (French)	----------	----------	2	----------	----------
Oceania (British)	----------	----------	----------	----------	1
	3, 861	1, 402	12, 316	----------	1
Grand total	5, 403, 749	4, 677, 368	2, 649, 457	5, 090, 138	4, 017, 785

TABLE 66.—*Anthracite exported, by districts and ports, 1920–1924, in net tons*

[Compiled from the records of the Bureau of Foreign and Domestic Commerce]

Customs district	Principal ocean port or rail gateway	1920	1921	1922	1923	1924
North Atlantic:						
Massachusetts	Boston	1,177	983	712	405	467
Connecticut		----------	----------	34	48	45
New York	New York	245,529	147,700	66,391	96,597	110,482
Philadelphia	Philadelphia	176,021	72,844	47,554	59,311	73,148
Maryland	Baltimore	939	4,087	12,314	11,091	----------
Virginia	Hampton Roads	19,777	5,464	----------	7,791	----------
		443,443	231,078	127,005	175,243	184,142
South Atlantic:						
South Carolina	Charleston	----------	----------	----------	3,454	----------
Florida	Pensacola	6,980	30	547	165	3
Mobile	Mobile	----------	----------	140	----------	45
New Orleans	New Orleans	9,513	----------	236	10	17
Galveston		----------	----------	1	----------	----------
Sabine		34	35	----------	----------	35
		16,527	65	924	3,629	100
Mexican border:						
Arizona		644	8,840	3,381	421	1,368
El Paso		2,465	496	1,667	1,929	1,626
San Antonio		14,254	40,153	1,211	1,607	577
		17,363	49,489	6,259	3,957	3,571
Pacific coast:						
Washington		1,197	1,206	137	2,585	3,178
Oregon		6,441	----------	----------	----------	----------
San Francisco		132	66	143	39	21
Los Angeles		17	5	2	174	63
San Diego		62	54	65	1	----------
		7,849	1,331	347	2,799	3,262
Lake Erie ports: Ohio [a]	Lower Lake docks	27,896	24,687	13,412	39,731	16,908
Rail gateways on Canadian border:						
Eastern—						
Maine and New Hampshire		843	866	812	408	159
Vermont		23,685	20,326	7,867	14,123	4,509
St. Lawrence		1,610,429	1,350,470	819,021	1,647,117	1,252,786
Rochester [b]		616,258	427,467	273,842	512,434	287,609
Buffalo		2,622,543	2,532,752	1,381,779	2,619,713	2,220,310
Michigan		1,569	3,230	3,827	7,893	7,618
		4,875,327	4,335,111	2,487,148	4,801,688	3,772,991
Western—						
Duluth, Superior, and International Falls		7,497	9,025	4,002	22,681	9,803
Dakota		7,763	26,582	10,190	40,369	27,007
		15,260	35,607	14,192	63,050	36,810
Miscellaneous:						
Alaska		----------	----------	2	6	----------
Porto Rico		84	----------	168	35	1
		84	----------	170	41	1
Grand total		5,403,749	4,677,368	2,649,457	5,090,138	4,017,785

[a] Chiefly Buffalo and Erie.

[b] Rail, car ferry, and Lake Ontario.

TABLE 67.—*Anthracite and bituminous coal exported to Canada, Mexico, and all other countries, by months, 1921–1924, in net tons*

[Compiled from the records of the Bureau of Foreign and Domestic Commerce]

	January	February	March	April	May	June	July	August	September	October	November	December	Total
1921													
Anthracite:													
Canada	305, 732	301, 827	331, 539	394, 317	464, 136	537, 286	428, 324	411, 724	309, 929	338, 922	358, 676	336, 803	4, 519, 215
Mexico	9, 012	8, 508	4, 536	6, 792	5, 602	2, 502	1, 320	3, 066	2, 849	2, 342	744	2, 546	49, 819
All other	9, 317	16, 649	8, 818	11, 649	16, 687	15, 616	4, 962	2, 976	6, 946	1, 548	9, 485	3, 681	108, 334
	324, 061	326, 984	344, 893	412, 758	486, 425	555, 404	434, 606	417, 766	319, 724	342, 812	368, 905	343, 030	4, 677, 368
Bituminous (not including fuel or bunker coal):													
Canada	1, 319, 219	704, 323	662, 544	813, 224	1, 259, 155	1, 581, 997	1, 466, 050	1, 477, 378	1, 158, 994	1, 259, 684	997, 574	696, 632	13, 396, 774
Mexico	36, 037	28, 904	14, 209	9, 284	8, 865	19, 970	16, 239	15, 236	15, 331	11, 622	9, 746	7, 433	192, 876
All other	1, 163, 006	676, 483	613, 308	793, 754	1, 532, 399	2, 110, 287	1, 485, 699	405, 887	182, 678	218, 634	200, 943	158, 438	9, 541, 516
	2, 518, 262	1, 409, 710	1, 290, 061	1, 616, 262	2, 800, 419	3, 712, 254	2, 967, 988	1, 898, 501	1, 357, 003	1, 489, 940	1, 208, 263	862, 503	23, 131, 166
1922													
Anthracite:													
Canada	245, 567	292, 854	305, 705	121, 085	62, 434	43, 700	16, 884	31, 678	97, 910	448, 281	485, 768	420, 584	2, 572, 450
Mexico	435	114	596	488	213	401	1, 134	305	1, 409	192	912	209	6, 408
All other	4, 923	14, 926	23, 822	832	5, 516	1, 017	684	165	11	5, 126	6, 801	6, 776	70, 599
	250, 925	307, 894	330, 123	122, 405	68, 163	45, 118	18, 702	32, 148	99, 330	453, 599	493, 481	427, 569	2, 649, 457
Bituminous (not including fuel or bunker coal):													
Canada	589, 138	740, 091	1, 091, 240	507, 814	304, 804	479, 191	324, 809	418, 420	1, 244, 089	1, 845, 002	1, 750, 540	1, 541, 209	10, 836, 347
Mexico	8, 039	5, 885	8, 836	18, 163	12, 228	6, 649	7, 184	6, 778	5, 327	7, 894	5, 245	9, 755	101, 983
All other	124, 006	165, 241	229, 715	274, 817	130, 465	119, 576	78, 248	51, 396	66, 592	84, 060	56, 416	94, 223	1, 474, 755
	721, 183	911, 217	1, 329, 791	800, 794	447, 497	605, 416	410, 241	476, 594	1, 316, 008	1, 936, 956	1, 812, 201	1, 645, 187	12, 413, 085
Fuel or bunker coal loaded on vessels engaged in foreign trade	424, 093	401, 569	464, 746	449, 313	470, 944	409, 116	360, 351	291, 657	291, 528	330, 000	371, 440	349, 875	4, 614, 632

TABLE 67.—*Anthracite and bituminous coal exported to Canada, Mexico, and all other countries, by months, 1921–1924, in net tons*—Con.

	January	February	March	April	May	June	July	August	September	October	November	December	Total
1923													
Anthracite:													
Canada	389,017	361,928	440,437	462,887	491,567	460,897	489,704	488,097	187,897	446,130	402,335	367,941	4,988,837
Mexico	205	216	608	709	155	137	227	394	432	290	461	397	4,231
All other	9,516	7,849	6,466	8,957	7,589	7,791	20,083	7,081	8,443	2,251	10,964	80	97,070
	398,738	369,993	447,511	472,553	499,311	468,825	510,014	495,572	196,772	448,671	413,760	368,418	5,090,138
Bituminous (not including fuel or bunker coal):													
Canada	1,121,848	817,725	1,031,104	996,688	1,772,824	2,041,756	1,902,764	1,964,449	1,695,594	1,397,706	1,159,274	952,525	16,854,257
Mexico	7,318	4,817	6,236	12,813	12,668	12,947	12,533	7,120	5,461	5,752	6,860	11,481	106,006
All other	93,968	80,148	329,027	541,564	733,389	654,318	636,333	399,565	279,799	264,096	237,724	243,385	4,493,316
	1,223,134	902,690	1,366,367	1,551,065	2,518,881	2,709,021	2,551,630	2,371,134	1,980,854	1,667,554	1,403,858	1,207,391	21,453,579
Fuel or bunker coal loaded on vessels engaged in foreign trade	358,954	352,782	405,157	388,065	512,624	492,643	481,839	506,754	439,631	413,503	393,138	347,934	5,093,024
1924													
Anthracite:													
Canada	299,645	339,924	342,136	268,815	299,697	374,939	311,722	275,252	359,253	398,263	306,028	352,324	3,927,999
Mexico	1,511	66	310	46	143	276	175	233	223	168	514		3,665
All other	3,490	4,855	3,906	5,624	4,782	12,696	11,942	9,091	6,032	7,141	9,541	7,022	86,121
	304,646	344,845	346,352	274,485	304,622	387,911	323,839	284,576	365,508	405,572	316,083	359,346	4,017,785
Bituminous (not including fuel or bunker coal):													
Canada	834,660	1,057,298	909,636	607,441	1,019,831	1,228,476	1,347,545	1,175,889	1,345,961	1,449,239	864,494	814,399	12,654,869
Mexico	6,527	7,644	11,011	10,635	7,225	10,763	5,028	5,140	6,969	7,649	5,046	7,870	91,507
All other	343,368	364,711	350,871	459,726	399,005	358,977	475,047	382,341	331,277	261,706	227,867	399,075	4,353,971
	1,184,555	1,429,653	1,271,518	1,077,802	1,426,061	1,598,216	1,827,620	1,563,370	1,684,207	1,718,594	1,097,407	1,221,344	17,100,347
Fuel or bunker coal loaded on vessels engaged in foreign trade	362,229	375,451	339,171	389,167	407,570	382,155	387,874	354,785	349,925	393,474	323,935	394,676	4,460,412

TABLE 68.—*Shipments of coal to Alaska, Hawaii, and Porto Rico, 1910-1924, net tons*

[Compiled from the records of the Bureau of Foreign and Domestic Commerce]

Year	Alaska (all coal)	Hawaii (all coal)	Porto Rico [a]	
			Anthracite	Bituminous
1910	32, 098	69, 054	3, 399	117, 678
1911	32, 255	1, 919	2, 704	113, 551
1912	27, 767	1, 137	2, 417	125, 723
1913	69, 066	38, 526	1, 465	131, 105
1914	41, 509	1, 475	4, 717	125, 196
1915	46, 329	4, 773	5, 755	125, 943
1916	44, 934	11, 697	2, 069	168, 367
1917	58, 116	39, 442	125, 635	
1918	51, 520	73, 006	116, 161	
1919	57, 166	42, 495	83, 492	
1920	38, 128	17, 634	104, 021	
1921	24, 278	9, 249	55, 800	
1922	28, 457	846	55, 356	
1923	34, 082	25, 344	49, 302	
1924	40, 161	49, 074	58, 434	

[a] Separate figures for anthracite and bituminous coal have not been given since 1916.

WORLD PRODUCTION OF COAL

TABLE 69.—*World production of coal of all grades, 1911-1924* [a]

Year	Production, in part estimated (metric tons)	Per cent produced by United States	Year	Production, in part estimated (metric tons)	Per cent produced by United States
1911	1, 189, 000, 000	37. 9	1918	1, 333, 000, 000	46. 3
1912	1, 249, 000, 000	38. 8	1919	1, 173, 000, 000	42. 8
1913	1, 342, 000, 000	38. 6	1920	1, 320, 000, 000	45. 3
1914	1, 207, 000, 000	38. 7	1921	1, 135, 000, 000	40. 5
1915	1, 193, 000, 000	40. 5	1922	1, 226, 000, 000	35. 3
1916	1, 291, 000, 000	41. 5	1923	1, 360, 000, 000	43. 9
1917	1, 356, 000, 000	43. 6	1924	1, 357, 000, 000	38. 2

[a] Includes lignite and subbituminous coal as reported, without attempting to reduce to equivalent tonnage of bituminous coal.

TABLE 70.—*Coal produced in the principal countries of the world in the calendar years 1922-1924* [a]

[In metric tons of 2,204.6 pounds]

Country	1922	1923	1924
North America:			
Canada—			
Coal	10. 587, 611	12, 163, 901	9, 138, 841
Lignite	3, 162, 907	3, 249, 605	3, 233, 459
Greenland	2, 100	2, 117	2, 500
Mexico	932, 550	1, 261, 541	1, 226, 696
United States—			
Anthracite	49, 607, 344	84, 675, 282	79, 765, 491
Bituminous and lignite	383, 073, 174	512, 161, 770	438, 790, 754
South America:			
Argentina	([b])	([b])	([b])
Brazil	500, 000	324, 154	342, 200
Chile	1, 053, 001	1, 164, 028	1, 539, 141
Colombia	([b])	([b])	([b])
Peru	294, 492	[c] 253, 000	151, 735
Venezuela	[d] 20, 782	[d] 18, 050	16, 695
Europe:			
Austria—			
Coal	165, 727	157, 650	171, 959
Lignite	3, 135, 902	2, 685, 467	2, 785, 816
Belgium	21, 208, 500	22, 922, 340	23, 361, 910

[a] Compiled by L. M. Jones, of the Bureau of Mines.

[b] Estimate included in total.

[c] Includes a small quantity of asphaltite.

[d] Exclusive of the output of the State of Falcon (about 8,000 tons), for which estimate is included in total.

TABLE 70.—*Coal produced in the principal countries of the world in the calendar years 1922–1924*—Continued

[In metric tons of 2,204.6 pounds]

Country	1922	1923	1924
Europe—Continued.			
Bulgaria—			
Coal	46, 725	61, 600	69, 670
Lignite	983, 311	1, 012, 594	1, 155, 291
Czechoslovakia—			
Coal	10, 464, 990	12, 347, 251	15, 178, 942
Lignite	19, 174, 296	16, 265, 530	20, 459, 690
France—			
Coal	31, 141, 096	37, 679, 314	44, 011, 240
Lignite	772, 014	877, 123	944, 080
Germany—			
Coal	[e] 129, 964, 597	62, 316, 134	118, 768, 748
Lignite	137, 207, 125	118, 784, 997	124, 637, 201
Saar	11, 240, 000	9, 192, 275	14, 032, 120
Greece—Lignite	131, 515	126, 000	129, 530
Hungary—			
Coal	941, 380	793, 075	744, 394
Lignite	6, 776, 230	6, 894, 958	6, 333, 286
Italy—			
Coal	195, 352	173, 700	126, 985
Lignite	745, 402	953, 460	917, 491
Netherlands—			
Coal	4, 866, 371	5, 595, 478	6, 180, 182
Lignite	28, 919	54, 185	191, 202
Poland—			
Coal	[f] 23, 974, 814	36, 097, 997	32, 224, 680
Lignite	219, 983	171, 035	88, 038
Portugal—			
Coal	127, 279	137, 613	124, 802
Lignite	14, 380	15, 952	8, 121
Rumania—			
Coal	254, 642	291, 983	297, 288
Lignite	1, 861, 579	2, 229, 410	2, 479, 083
Russia	7, 781, 400	[g] 14, 504, 300	[h] 13, 918, 000
Spain—			
Coal	4, 435, 843	5, 971, 446	6, 127, 586
Lignite	329, 680	394, 268	411, 773
Spitzbergen	316, 000	340, 942	451, 914
Sweden	378, 861	419, 569	437, 856
Switzerland	3, 380	(b)	(b)
United Kingdom—			
Great Britain	253, 613, 054	280, 430, 369	271, 405, 414
Ireland	(b)	(b)	(b)
Yugoslavia	3, 726, 568	4, 001, 265	4, 185, 240
Asia:			
British Borneo	88, 948	(b)	(b)
China	22, 681, 000	19, 955, 000	20, 969, 000
Chosen	317, 330	279, 978	399, 415
Dutch East Indies	1, 032, 310	1, 156, 625	1, 446, 757
Federated Malay States	286, 351	322, 994	378, 778
India, British	19, 316, 112	19, 972, 376	21, 516, 491
Indo-China	988, 991	1, 056, 921	1, 235, 880
Japan (including Taiwan and Karafuto)—			
Coal	29, 163, 727	30, 417, 012	31, 617, 277
Lignite	166, 302	151, 462	176, 764
Philippine Islands	42, 420	43, 446	47, 183
Russia	1, 276, 900	(g)	[h] 2, 271, 000
Turkey	681, 000	(b)	(b)
Africa:			
Algeria	8, 855	3, 562	9, 228
Belgian Congo	33, 000	65, 000	81, 000
Nigeria	123, 027	173, 422	183, 000
Rhodesia, Southern	467, 787	559, 999	591, 526
Tunisia	343	620	305
Union of South Africa	9, 271, 948	11, 252, 305	11, 819, 988
Oceania:			
Australia—			
New South Wales	10, 346, 572	10, 646, 693	11, 804, 688
Queensland	973, 903	1, 077, 686	1, 141, 143
Tasmania	70, 349	82, 014	77, 208
Victoria	660, 113	603, 240	656, 170
Western Australia	445, 480	427, 466	428, 635
New Zealand—			
Bituminous	983, 981	950, 715	1, 102, 418
Lignite	903, 656	1, 050, 735	1, 014, 224
	1, 226, 000, 000	1, 360, 000, 000	1, 357, 000, 000

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[b] Estimate included in total.

[e] Includes entire output of Upper Silesia for January to May, inclusive; for June to December, inclusive, only that part of the province allocated to Germany.

[f] Includes the output June to December, inclusive, of that part of Upper Silesia allocated to Poland.

[g] Russia in Asia included under Russia in Europe.

[h] Data for operating year, Oct. 1, 1923, to Sept. 30, 1924.

DETAILED STATISTICS OF BITUMINOUS COAL BY STATES AND COUNTIES

TABLES OF PRODUCTION, VALUE, MEN EMPLOYED, DAYS WORKED, AND OUTPUT PER MAN, 1923–24

The following tables (Nos. 71 to 77) present the detailed data for each coal-producing county from which three or more operators reported production. Where less than three reports were received the figures for two or more counties have been combined to avoid disclosing individual returns.

Two series of data are shown for bituminous coal. The first series, presented in Tables 71 to 76, gives the details of value of product, men employed by broad occupational groups, average number of days worked by the mines, and average output per man per day. In this series, the producing States appear in alphabetical order, except for Alaska and the small producers: California, Georgia, Idaho, Nebraska, Nevada, North Carolina, and Oregon, which for convenience in printing have been grouped together on pages 554 and 555.

A second series of data, given in Table 77, shows for each county the tonnage produced for each of the five years 1920 to 1924.

TABLE 71.—*Production, value, men employed, days worked, and output per man at coal mines in specified States and counties, 1923–24*

[Note that figures of men employed and days worked for 1924 do not include mines that operated in 1923 but were idle the entire year 1924; they do include many mines operated for a short time only in 1924]

ALABAMA [a]

County	Net tons					Value		Number of employees				Average number of days worked	Average tons per man per day
								Underground					
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	All others	Surface	Total		
1923													
Bibb	1, 192, 795	5, 338	28, 938		1, 227, 071	$3, 345, 000	$2. 73	1, 174	498	392	2, 064	207	2. 87
Blount	257, 007	1, 508	5, 000		263, 515	667, 000	2. 53	358	57	99	514	165	3. 10
Etowah	128, 118	1, 864	2, 173		132, 155	366, 000	2. 77	161	25	50	236	302	1. 85
Jefferson	9, 410, 779	113, 367	170, 221	55, 502	9, 749, 869	24, 562, 000	2. 52	7, 338	3, 921	2, 288	13, 547	254	2. 83
St. Clair	772, 016	4, 617	26, 648		803, 281	1, 984, 000	2. 47	503	206	85	794	271	3. 73
Shelby	660, 113	4, 990	11, 374		676, 477	2, 198, 000	3. 25	872	339	234	1, 445	201	2. 32
Tuscaloosa	974, 009	22, 577	17, 238	203, 403	1, 217, 227	2, 742, 000	2. 25	1, 028	423	294	1, 745	258	2. 70
Walker	5, 898, 200	211, 965	38, 903		6, 149, 068	15, 011, 000	2. 44	5, 619	1, 781	1, 894	9, 294	205	3. 23
Winston	19, 736	2, 100			21, 836	66, 000	3. 02	44	15	15	74	112	2. 62
Other counties [b]	169, 851	2, 428	6, 861		179, 140	598, 000	3. 34	207	65	50	322	215	2. 58
Total, excluding wagon mines	19, 482, 624	370, 754	307, 356	258, 905	20, 419, 639	51, 539, 000	2. 52	17, 304	7, 330	5, 401	30, 035	232	2. 93
Wagon mines served by rail	38, 010				38, 010	85, 000	2. 23						
Grand total	19, 520, 634	370, 754	307, 356	258, 905	20, 457, 649	51, 624, 000	2. 52						
1924													
Bibb	1, 045, 175	6, 260	21, 098		1, 072, 533	2, 722, 000	2. 54	1, 205	471	353	2, 029	183	2. 89
Blount	123, 132	1, 100	1, 770		126, 002	262, 000	2. 08	210	64	49	323	149	2. 62
Etowah	127, 447	1, 543	2, 225		131, 215	342, 000	2. 61	178	36	56	270	210	2. 31
Jefferson	9, 340, 280	94, 786	98, 424	58, 972	9, 592, 462	23, 008, 000	2. 40	6, 960	3, 885	1, 939	12, 784	240	3. 12
Shelby	690, 032	10, 141	13, 414		713, 587	2, 430, 000	3. 41	741	361	253	1, 355	237	2. 22
Tuscaloosa	989, 658	6, 923	19, 167	112, 088	1, 127, 836	2, 360, 000	2. 09	906	394	280	1, 580	235	3. 04
Walker	5, 282, 465	220, 175	28, 122		5, 530, 762	11, 463, 000	2. 07	5, 018	1, 710	1, 763	8, 491	196	3. 33
Winston	20, 071	1, 500			21, 571	57, 000	2. 64	35	10	12	57	166	2. 27
Other counties [c]	776, 834	6, 152	31, 230		814, 216	2, 112, 000	2. 59	639	285	143	1, 067	221	3. 46
Total, excluding wagon mines	18, 395, 094	348, 580	215, 450	171, 060	19, 130, 184	44, 756, 000	2. 34	15, 892	7, 216	4, 848	27, 956	220	3. 11

ARKANSAS [d]

1923													
Franklin	246, 487	1, 791	5, 763	-----	254, 041	$845, 000	$3. 33	272	99	241	612	105	3. 97
Johnson	174, 110	1, 542	4, 139	-----	179, 791	898, 000	4. 99	330	170	235	735	78	3. 15
Logan	79, 535	3, 820	1, 171	-----	84, 526	521, 000	6. 16	248	83	44	375	104	2. 17
Sebastian	620, 960	1, 583	20, 174	-----	642, 717	2, 197, 000	3. 42	1, 180	456	243	1, 879	94	3. 65
Other counties [e]	60, 608	4, 109	7, 450	-----	72, 167	524, 000	7. 26	94	38	21	153	189	2. 48
Total, excluding wagon mines	1, 181, 700	12, 845	38, 697	-----	1, 233, 242	4, 985, 000	4. 01	2, 124	846	784	3, 754	97	3. 39
Wagon mines served by rail	63, 650	-----	-----	-----	63, 650	207, 000	3. 26	-----	-----	-----	-----	-----	-----
Grand total	1, 245, 350	12, 845	38, 697	-----	1, 296, 892	5, 192, 000	4. 01	-----	-----	-----	-----	-----	-----
1924													
Franklin	216, 602	2, 263	10, 539	-----	229, 404	706, 000	3. 08	167	60	276	503	126	3. 62
Johnson	282, 104	2, 629	6, 219	-----	290, 952	1, 412, 000	4. 85	404	217	307	928	103	3. 04
Logan	151, 318	6, 082	2, 119	-----	159, 519	993, 000	6. 22	267	96	56	419	153	2. 49
Sebastian	690, 973	2, 035	10, 178	-----	703, 186	2, 329, 000	3. 31	898	324	151	1, 373	143	3. 58
Other counties [f]	61, 932	2, 010	4, 500	-----	68, 442	458, 000	6. 69	75	35	17	127	228	2. 36
Total, excluding wagon mines	1, 402, 929	15, 019	33, 555	-----	1, 451, 503	5, 898, 000	4. 06	1, 811	732	807	3, 350	134	3. 24

COLORADO [g]

1923													
Archuleta, Moffat, Montezuma, Montrose, and Pitkin	2, 091	9, 939	100	-----	12, 130	$38, 000	$3. 22	21	3	3	27	171	2. 62
Boulder	556, 035	36, 149	35, 818	-----	628, 002	1, 690, 000	2. 69	538	224	126	888	155	4. 56
Delta	79, 966	27, 239	395	-----	107, 600	342, 000	3. 18	70	16	27	113	165	5. 76
Elbert and Jefferson	140, 514	6, 783	9, 490	-----	156, 787	346, 000	2. 21	106	53	28	187	211	3. 98
El Paso	196, 438	147, 030	12, 115	-----	355, 583	1, 030, 000	2. 90	234	86	55	375	185	5. 11
Fremont	526, 335	80, 670	6, 458	-----	613, 463	2, 658, 000	4. 33	649	284	158	1, 091	164	3. 43
Garfield	202	22, 138	-----	-----	22, 340	80, 000	3. 54	31	4	2	37	163	3. 70
Gunnison	509, 659	7, 409	25, 924	-----	542, 992	1, 835, 000	3. 38	363	137	153	653	182	4. 56
Huerfano	1, 928, 472	20, 727	16, 218	-----	1, 965, 417	7, 319, 000	3. 72	1, 442	571	452	2, 465	175	4. 20
Jackson	55, 500	1, 660	100	-----	57, 260	121, 000	2. 11	46	11	19	76	266	2. 83
La Plata	68, 577	27, 860	28	14, 292	110, 757	341, 000	3. 08	99	30	16	145	223	3. 43
Las Animas	2, 900, 287	57, 477	55, 995	175, 743	3, 189, 502	10, 245, 000	3. 21	2, 797	956	653	4, 406	184	3. 94
Mesa	148, 344	30, 025	2, 205	-----	180, 574	510, 000	2. 82	188	55	37	280	195	3. 31
Rio Blanco	-----	3, 706	-----	-----	3, 706	13, 000	3. 78	5	1	-----	6	240	2. 57

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[a] The number of active mines of commercial size in Alabama was 288 in 1923 and 238 in 1924.

[b] Franklin and Marion.

[c] Marion and St. Clair.

[d] The number of active mines of commercial size in Arkansas was 94 in 1923 and 86 in 1924.

[e] Pope, Scott, and Washington.

[f] Pope and Scott.

[g] The number of active mines of commercial size in Colorado was 236 in 1923 and 231 in 1924.

TABLE 71.—*Production, value, men employed, days worked, and output per man at coal mines in specified States and counties, 1923–24*—Continued

COLORADO—Continued

County	Net tons					Value		Number of employees				Average number of days worked	Average tons per man per day
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Total	Average per ton	Underground		Surface	Total		
								Miners, loaders, and shot firers	All others				
1923—Continued													
Routt	745,508	16,099	41,848		803,455	$3,120,000	$3.88	592	218	248	1,058	[b] 57	13.43
Weld	1,512,976	39,553	24,901		1,577,430	3,555,000	2.25	883	465	185	1,533	193	5.34
Total, excluding wagon mines	9,370,904	534,464	231,595	190,035	10,326,998	33,243,000	3.22	8,064	3,114	2,162	13,340	174	4.45
Wagon mines served by rail	19,220				19,220	56,000	2.92						
Grand total	9,390,124	534,464	231,595	190,035	10,346,218	33,299,000	3.22						
1924													
Archuleta, Jackson, Montrose, and Pitkin	63,600	8,657	587		72,844	177,000	2.43	45	12	18	75	174	5.58
Boulder	601,015	50,430	32,099		683,544	1,807,000	2.64	584	240	111	935	167	4.37
Delta	58,414	28,911			87,325	251,000	2.87	67	14	14	95	145	6.33
Elbert		2,342	117		2,459	5,000	2.03	6	2	2	10	136	1.81
El Paso	202,800	149,551	11,590		363,941	965,000	2.65	277	65	43	385	203	4.66
Fremont	607,434	77,522	13,344		698,300	2,675,000	3.83	683	262	164	1,109	184	3.42
Garfield	14,048	11,972	400		26,420	63,000	2.38	25	5	3	33	215	3.72
Gunnison	436,754	6,618	25,649		469,021	1,518,000	3.24	395	143	142	680	148	4.64
Huerfano	1,956,870	18,635	15,236		1,990,741	6,952,000	3.49	1,577	540	471	2,588	201	3.83
Jefferson	114,743	4,404	8,235		127,382	268,000	2.10	85	40	19	144	215	4.12
La Plata	50,914	27,046	125	14,051	92,136	282,000	3.06	90	23	22	135	172	3.96
Las Animas	2,874,638	68,078	56,578	119,278	3,118,572	9,838,000	3.15	2,468	940	538	3,946	191	4.13
Mesa	110,118	25,271	100		135,489	342,000	2.52	128	30	32	190	174	3.99
Moffat		6,963			6,963	12,000	1.72	7	3	2	12	145	4.02
Montezuma	1,650	3,834			5,484	23,000	4.19	13	1	1	15	218	1.68
Rio Blanco		3,186	2		3,188	10,000	3.14	8	1	2	11	175	1.66
Routt	850,115	15,035	46,493		911,643	3,116,000	3.42	673	257	222	1,152	[b] 70	11.28
Weld	1,569,421	53,084	26,141		1,648,646	3,559,000	2.16	892	400	147	1,439	197	5.82
Total, excluding wagon mines	9,512,534	561,539	236,696	133,329	10,444,098	31,863,000	3.05	8,023	2,978	1,953	12,954	178	4.52

ILLINOIS [i]

1923													
Bond, Jefferson, Johnson, and White	305, 768	9, 915	6, 384		322, 067	$738, 000	$2. 29	422	149	82	653	109	4. 52
Bureau	429, 125	62, 212	34, 035		525, 372	1, 855, 000	3. 53	1, 041	317	157	1, 515	139	2. 49
Cass, Edgar, Greene, Hancock, Moultrie, Schuyler, and Warren	104, 275	17, 152	9, 749		131, 176	344, 000	2. 62	149	35	17	201	176	3. 71
Christian	3, 760, 389	172, 142	55, 451		3, 987, 982	8, 640, 000	2. 17	2, 463	879	441	3, 783	178	5. 92
Clinton	636, 803	71, 569	36, 700		745, 072	1, 767, 000	2. 37	937	286	117	1, 340	90	6. 15
Franklin	13, 286, 349	124, 149	285, 491		13, 695, 989	37, 711, 000	2. 75	9, 498	4, 791	1, 948	16, 237	166	5. 07
Fulton	2, 051, 722	71, 758	27, 344		2, 150, 824	5, 864, 000	2. 73	2, 039	687	240	2, 966	172	4. 22
Gallatin	26, 400	700	2, 000		29, 100	78, 000	2. 68	158	69	40	267	34	3. 23
Grundy	164, 910	16, 422	12, 805		194, 137	774, 000	3. 99	260	96	44	400	199	2. 44
Henry	20, 000	36, 624	1, 756		58, 380	177, 000	3. 03	90	17	16	123	185	2. 57
Jackson	1, 267, 348	51, 639	35, 097		1, 354, 084	3, 409, 000	2. 52	1, 035	408	206	1, 649	156	5. 28
Knox		15, 636	508		16, 144	48, 000	2. 97	33	5	5	43	167	2. 25
La Salle	227, 643	304, 457	13, 583		545, 683	1, 918, 000	3. 51	629	169	125	923	198	2. 98
Livingston	3, 863	38, 218	1, 470		43, 551	159, 000	3. 65	110	24	16	150	121	2. 40
Logan, McLean, Putnam, Will, and Woodford	681, 793	157, 402	45, 026		884, 221	2, 458, 000	2. 78	1, 158	317	163	1, 638	215	2. 51
McDonough		2, 861			2, 861	12, 000	4. 19	16			16	92	1. 95
Macon	20, 037	170, 274	7, 347		197, 658	777, 000	3. 93	266	139	30	435	167	2. 71
Macoupin	6, 966, 593	114, 167	192, 730		7, 273, 490	16, 634, 000	2. 29	4, 738	2, 078	620	7, 436	165	5. 91
Madison	3, 416, 031	280, 526	114, 288		3, 810, 845	9, 110, 000	2. 39	2, 914	1, 209	357	4, 480	147	5. 77
Marion	638, 148	37, 940	44, 200		720, 288	1, 748, 000	2. 43	671	226	101	998	155	4. 65
Marshall	283, 263	22, 830	11, 982		318, 075	1, 228, 000	3. 86	517	133	50	700	228	1. 99
Menard	21, 193	50, 994	2, 164		74, 351	227, 000	3. 05	160	48	31	239	101	3. 09
Mercer	119, 903	10, 277	1, 275		131, 455	385, 000	2. 93	112	31	21	164	214	3. 75
Montgomery	2, 645, 489	43, 038	64, 363		2, 752, 890	6, 829, 000	2. 48	2, 371	1, 055	303	3, 729	143	5. 16
Peoria	1, 013, 860	127, 252	9, 656		1, 150, 768	3, 015, 000	2. 62	1, 070	346	136	1, 552	185	4. 01
Perry	2, 293, 692	147, 767	83, 089		2, 524, 548	5, 223, 000	2. 07	2, 498	903	466	3, 867	123	5. 32
Randolph	1, 635, 369	31, 806	35, 297		1, 702, 472	4, 188, 000	2. 46	1, 387	609	204	2, 200	149	5. 20
Rock Island	3, 000	25, 200	1, 067		29, 267	77, 000	2. 63	48	11	6	65	138	3. 26
St. Clair	4, 643, 852	384, 072	124, 024		5, 151, 948	10, 821, 000	2. 10	4, 780	1, 362	618	6, 760	133	5. 72
Saline	5, 134, 291	66, 733	131, 877		5, 332, 901	14, 283, 000	2. 68	4, 745	2, 020	801	7, 566	138	5. 11
Sangamon	7, 040, 597	309, 594	126, 854		7, 477, 045	17, 369, 000	2. 32	6, 093	2, 114	835	9, 042	179	4. 61
Shelby	28, 878	26, 761	4, 000		59, 639	210, 000	3. 52	127	34	16	177	160	2. 11
Stark		8, 639	5		8, 644	31, 000	3. 59	20	1	2	23	180	2. 08
Tazewell	630, 205	132, 353	7, 929		770, 487	2, 081, 000	2. 70	610	166	72	848	216	4. 20
Vermilion	3, 799, 454	324, 640	52, 575		4, 176, 669	10, 571, 000	2. 53	2, 202	873	700	3, 775	232	4. 76
Washington	410, 613	44, 143	15, 475		470, 231	1, 279, 000	2. 72	454	215	66	735	117	5. 46
Williamson	10, 073, 511	94, 907	263, 322		10, 431, 740	26, 170, 000	2. 51	8, 373	3, 078	1, 568	13, 019	139	5. 76
Total, excluding wagon mines	73, 784, 367	3, 606, 769	1, 860, 918		79, 252, 054	198, 208, 000	2. 50	64, 194	24, 900	10, 620	99, 714	158	5. 02
Wagon mines served by rail	58, 021				58, 021	180, 000	3. 10						
Grand total	73, 842, 388	3, 606, 769	1, 860, 918		79, 310, 075	198, 388, 000	2. 50						

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[h] In this county the mines in recent times followed the practice of reducing their forces in periods of dull market and of working every day underground when the tipple works only one, two, or three days a week. As the figures of days worked represent tipple time, the result is not comparable with the returns for other counties, and the average for the State is affected also.

[i] The number of active mines of commercial size in Illinois was 575 in 1923 and 488 in 1924.

TABLE 71.—*Production, value, men employed, days worked, and output per man at coal mines in specified States and counties, 1923–24*—Continued

ILLINOIS—Continued

County	Net tons					Value		Number of employees				Average number of days worked	Average tons per man per day
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Total	Average per ton	Underground		Surface	Total		
								Miners, loaders, and shot firers	All others				
1924													
Bond, Clinton, Gallatin, Jefferson, and White	1,379,101	89,135	56,935	------	1,525,171	$3,040,000	$1.99	1,453	345	216	2,014	147	5.15
Bureau	335,448	54,330	27,464	------	417,242	1,421,000	3.40	976	266	125	1,367	126	2.42
Cass, Edgar, Greene, Hancock, Macon, Schuyler, Scott, Shelby, and Warren	68,310	174,222	9,736	------	252,268	859,000	3.41	346	145	44	535	163	2.89
Christian	3,461,984	167,749	46,513	------	3,676,246	7,450,000	2.03	2,503	787	312	3,602	162	6.30
Franklin	12,625,266	114,714	170,582	------	12,910,562	31,520,000	2.44	8,682	4,029	1,464	14,175	177	5.15
Fulton	1,762,349	81,665	15,178	------	1,859,192	4,436,000	2.39	1,926	519	351	2,796	146	4.56
Grundy	358,390	15,179	11,713	------	385,282	1,095,000	2.84	414	155	57	626	222	2.77
Henry	16,291	26,819	1,802	------	44,912	163,000	3.63	136	38	21	195	185	1.24
Jackson	1,465,764	53,219	22,453	------	1,541,436	3,418,000	2.22	950	410	235	1,595	158	6.13
Knox	------	7,731	616	------	8,347	23,000	2.76	23	3	5	31	142	1.90
La Salle	284,397	285,800	11,852	------	582,049	1,892,000	3.25	912	186	118	1,216	183	2.62
Livingston	------	25,336	1,730	------	27,066	96,000	3.55	64	27	17	108	97	2.59
Logan, McLean, Putnam, Will, and Woodford	415,886	151,314	26,795	------	593,995	1,766,000	2.97	1,284	308	158	1,750	135	2.52
McDonough	------	2,733	------	------	2,733	11,000	4.02	14	------	------	14	157	1.24
Macoupin	5,632,873	81,774	125,972	------	5,840,619	12,442,000	2.13	3,807	1,664	454	5,925	163	6.04
Madison	2,980,098	206,351	87,097	------	3,273,546	6,922,000	2.11	3,011	1,051	323	4,385	119	6.26
Marion	299,014	36,875	32,427	------	368,316	773,000	2.10	559	185	89	833	118	3.76
Marshall	145,563	13,964	7,226	------	166,753	601,000	3.60	508	99	82	689	114	2.12
Menard	1,150	49,080	1,910	------	52,140	157,000	3.01	52	18	7	77	180	3.75
Mercer	99,126	17,056	------	------	116,182	325,000	2.80	103	30	22	155	163	4.59
Montgomery	2,419,188	35,827	46,544	------	2,501,559	5,362,000	2.14	1,938	857	256	3,051	142	5.78
Peoria	745,452	130,207	8,099	------	883,758	2,178,000	2.46	1,105	286	124	1,515	145	4.03
Perry	1,813,461	73,496	58,419	------	1,945,376	4,003,000	2.06	1,609	624	325	2,558	127	5.98
Randolph	1,087,865	31,044	33,724	------	1,152,633	2,986,000	2.59	1,202	458	148	1,808	114	5.58
Rock Island	1,200	18,118	452	------	19,770	57,000	2.88	29	10	7	46	99	4.35
St. Clair	3,078,399	385,613	81,506	------	3,545,518	6,875,000	1.94	4,059	1,215	463	5,737	113	5.49
Saline	4,725,394	72,390	102,373	------	4,900,157	11,229,000	2.29	4,276	1,789	659	6,724	146	5.00
Sangamon	5,637,737	349,377	89,175	------	6,076,289	13,054,000	2.15	6,971	2,025	646	9,642	139	4.54
Stark	------	5,512	10	------	5,522	17,000	3.08	21	1	1	23	151	1.59
Tazewell	640,081	116,029	6,095	------	762,205	2,030,000	2.66	607	207	82	896	201	4.23

Vermilion	3, 045, 705	303, 445	37, 333		3, 386, 483	7, 968, 000	2. 35	2, 400	860	576	3, 836	171	5. 15
Washington	114, 919	56, 940	6, 468		178, 327	434, 000	2. 43	465	181	73	719	54	4. 64
Williamson	9, 049, 509	86, 656	185, 462		9, 321, 627	20, 657, 000	2. 22	7, 046	2, 528	1, 146	10, 720	145	6. 00
Total, excluding wagon mines	63, 689, 920	3, 319, 700	1, 313, 661		68, 323, 281	155, 260, 000	2. 27	59, 451	21, 306	8, 606	89, 363	148	5. 16

INDIANA [f]

1923													
Clay	580, 068	56, 706	8, 619		645, 393	$1, 394, 000	$2. 16	585	208	297	1, 090	100	5. 92
Daviess	142, 253	21, 589	8, 089		171, 931	364, 000	2. 11	197	81	39	317	105	5. 16
Dubois and Perry		7, 351	104		7, 455	22, 000	2. 95	11	4	2	17	191	2. 30
Fountain and Warren		2, 514			2, 514	10, 000	3. 98	9			9	189	1. 48
Gibson	506, 235	15, 495	20, 470		542, 200	1, 272, 000	2. 34	707	263	86	1, 056	100	5. 12
Greene	2, 309, 237	55, 690	28, 395		2, 393, 322	5, 767, 000	2. 41	1, 731	633	548	2, 912	121	6. 78
Knox	3, 404, 670	44, 501	61, 671		3, 510, 842	8, 276, 000	2. 36	2, 840	960	330	4, 130	134	6. 36
Owen	90, 714	1, 162	2, 110		93, 986	241, 000	2. 56	16	3	77	96	118	8. 28
Parke	82, 644	23, 642	3, 977		110, 263	259, 000	2. 35	148	42	27	217	129	3. 93
Pike	1, 749, 939	29, 264	39, 121		1, 818, 324	4, 092, 000	2. 25	1, 089	393	498	1, 980	136	6. 77
Spencer	4, 467	2, 270	140		6, 877	14, 000	2. 04	27	7	4	38	65	2. 79
Sullivan	5, 372, 203	54, 411	83, 896		5, 510, 510	13, 601, 000	2. 47	4, 244	1, 947	814	7, 005	150	5. 24
Vanderburg	120, 507	178, 772	9, 305		308, 584	810, 000	2. 62	256	93	37	386	167	4. 78
Vermilion	3, 101, 624	34, 760	110, 914		3, 247, 298	8, 019, 000	2. 47	3, 422	1, 095	471	4, 988	145	4. 48
Vigo	6, 458, 083	144, 357	179, 295		6, 781, 735	18, 470, 000	2. 72	6, 691	2, 200	770	9, 661	134	5. 22
Warrick	937, 801	25, 348	23, 512		986, 661	2, 152, 000	2. 18	804	299	403	1, 506	127	5. 17
Total, excluding wagon mines	24, 860, 445	697, 832	579, 618		26, 137, 895	64, 763, 000	2. 48	22, 777	8, 228	4, 403	35, 408	136	5. 43
Wagon mines served by rail	91, 204				91, 204	283, 000	3. 10						
Grand total	24, 951, 649	697, 832	579, 618		26, 229, 099	65, 046, 000	2. 48						
1924													
Clay	646, 317	74, 863	9, 437		730, 617	1, 378, 000	1. 89	381	105	258	744	157	6. 23
Daviess	80, 784	13, 668	1, 970		96, 422	192, 000	1. 99	105	44	23	172	133	4. 22
Dubois and Perry		10, 241			10, 241	35, 000	3. 42	9	3	2	14	180	4. 05
Fountain and Warren		2, 083			2, 083	7, 000	3. 36	10			10	72	2. 89
Gibson	808, 333	17, 754	20, 275		846, 362	1, 692, 000	2. 00	799	301	95	1, 195	130	5. 46
Greene	1, 807, 093	48, 638	17, 964		1, 873, 695	3, 713, 000	1. 98	1, 321	402	392	2, 115	123	7. 22
Knox	2, 249, 015	81, 872	33, 128		2, 364, 015	5, 001, 000	2. 12	2, 275	759	268	3, 302	116	6. 17
Owen	103, 190	1, 781	2, 700		107, 671	224, 000	2. 08	13	2	87	102	139	7. 59
Parke	70, 519	10, 015	4, 000		84, 534	232, 000	2. 74	91	35	11	137	157	3. 94
Pike	1, 958, 808	13, 729	27, 710		2, 000, 247	4, 563, 000	2. 28	740	362	555	1, 657	170	7. 11
Spencer	7, 079	2, 854			9, 933	17, 000	1. 71	14	4	3	21	119	3. 96
Sullivan	4, 803, 464	50, 550	65, 183		4, 919, 197	10, 626, 000	2. 16	3, 347	1, 468	622	5, 437	157	5. 77
Vanderburg	99, 307	178, 491	9, 605		287, 403	630, 000	2. 19	327	89	29	445	152	4. 24
Vermilion	2, 111, 562	39, 164	57, 567		2, 208, 293	4, 875, 000	2. 21	2, 097	651	246	2, 994	151	4. 89
Vigo	4, 784, 799	152, 138	142, 755		5, 079, 692	11, 694, 000	2. 30	5, 527	1, 768	625	7, 920	119	5. 37
Warrick	808, 146	27, 720	23, 942		859, 808	1, 574, 000	1. 83	661	217	415	1, 293	123	5. 42
Total, excluding wagon mines	20, 338, 416	725, 561	416, 236		21, 480, 213	46, 453, 000	2. 16	17, 717	6, 210	3, 631	27, 558	136	5. 75

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[f] The number of active mines of commercial size in Indiana was 301 in 1923 and 248 in 1924.

TABLE 71.—*Production, value, men employed, days worked, and output per man at coal mines in specified States and counties, 1923–24*—Continued

IOWA[k]

County	Net tons					Value		Number of employees				Average number of days worked	Average tons per man per day
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Total	Average per ton	Underground		Surface	Total		
								Miners, loaders, and shot firers	All others				
1923													
Appanoose	863, 671	48, 737	19, 259		931, 667	$3, 464, 000	$3. 72	2, 364	488	248	3, 100	146	2. 06
Boone	216, 092	46, 235	2, 107		264, 434	1, 222, 000	4. 62	402	215	51	668	178	2. 22
Dallas	527, 520	14, 430	3, 911		545, 861	1, 915, 000	3. 51	646	272	90	1, 008	213	2. 54
Guthrie, Lucas, and Wayne	696, 154	9, 144	19, 821		725, 119	2, 509, 000	3. 46	617	247	76	940	187	4. 13
Jasper	81, 852	15, 223	6, 316		103, 391	363, 000	3. 51	122	70	27	219	142	3. 32
Jefferson, Keokuk, and Van Buren	6, 927	7, 659			14, 586	41, 000	2. 81	26	3	2	31	193	2. 44
Mahaska	26, 702	9, 720	989		37, 411	130, 000	3. 47	72	12	7	91	169	2. 43
Marion	675, 054	42, 686	22, 577		740, 317	2, 478, 000	3. 35	850	337	111	1, 298	203	2. 81
Monroe	1, 490, 213	32, 536	35, 033		1, 557, 782	5, 510, 000	3. 53	1, 630	601	180	2, 411	198	3. 27
Page and Taylor	9, 954	18, 685			28, 639	136, 000	4. 75	57	14	6	77	219	1. 70
Polk	380, 606	274, 802	12, 423		667, 831	2, 428, 000	3. 63	852	397	122	1, 371	191	2. 55
Wapello	150	32, 267	650		33, 067	108, 000	3. 27	67	10	6	83	146	2. 73
Warren	43, 857	4, 056	3, 967		51, 880	187, 000	3. 60	92	43	16	151	174	1. 98
Total, excluding wagon mines	5, 018, 752	556, 180	127, 053		5, 701, 985	20, 491, 000	3. 59	7, 797	2, 709	942	11, 448	181	2. 75
Wagon mines served by rail	8, 750				8, 750	26, 000	3. 00						
Grand total	5, 027, 502	556, 180	127, 053		5, 710, 735	20, 517, 000	3. 59						
1924													
Adams		7, 796	3		7, 799	33, 000	4. 23	31	5	5	41	171	1. 11
Appanoose	711, 641	88, 128	14, 031		813, 800	2, 860, 000	3. 51	2, 408	483	240	3, 131	134	1. 95
Boone	227, 799	63, 727	3, 568		295, 094	1, 189, 000	4. 03	471	208	49	728	176	2. 30
Dallas	516, 011	14, 534	4, 306		534, 851	1, 772, 000	3. 31	603	265	87	955	196	2. 86
Davis, Jefferson, Lucas, and Warren	630, 368	14, 790	24, 051		669, 209	1, 966, 000	2. 94	548	197	84	829	182	4. 43
Greene		3, 156			3, 156	16, 000	5. 07	15	3	3	21	114	1. 32
Guthrie		5, 112	36		5, 148	25, 000	4. 86	24	4	3	31	137	1. 21
Jasper	77, 089	25, 867	6, 682		109, 638	377, 000	3. 44	122	70	34	226	154	3. 14
Keokuk		9, 673	562		10, 235	32, 000	3. 13	16	7	7	30	126	2. 71
Mahaska	4, 729	52, 208	513		57, 450	175, 000	3. 05	136	41	35	212	105	2. 58
Marion	767, 102	44, 150	24, 389		835, 641	2, 525, 000	3. 02	869	276	114	1, 259	195	3. 41

Monroe	992, 828	63, 544	29, 511		1, 085, 883	3, 549, 000	3. 27	1, 660	577	152	2, 389	151	3. 01
Page and Taylor	5, 998	26, 250	50		32, 298	146, 000	4. 52	64	8	9	81	207	1. 92
Polk	400, 538	478, 612	13, 932		893, 082	3, 028, 000	3. 39	1, 140	474	174	1, 788	176	2. 84
Story and Webster		6, 692	200		6, 892	28, 000	4. 06	17	5	5	27	216	1. 18
Van Buren	4, 189	4, 406	50		8, 645	27, 000	3. 12	17	6	5	28	142	2. 18
Wapello	1, 800	69, 397	1, 213		72, 410	255, 000	3. 52	150	31	27	208	154	2. 26
Wayne	11, 160	15, 351	708		27, 219	94, 000	3. 45	91	17	9	117	128	1. 81
Total, excluding wagon mines	4, 351, 252	993, 393	123, 805		5, 468, 450	18, 097, 000	3. 31	8, 382	2, 677	1, 042	12, 101	161	2. 80

KANSAS [l]

1923													
Cherokee	649, 940	57, 747	17, 479		725, 166	$2, 151, 000	$2. 97	726	139	333	1, 198	121	5. 00
Crawford	3, 188, 543	157, 663	63, 918		3, 410, 124	10, 986, 000	3. 22	5, 460	1, 325	675	7, 460	138	3. 31
Leavenworth and Osage	101, 503	49, 872	668		152, 043	620, 000	4. 08	628	155	97	880	189	0. 91
Linn	37, 645	2, 800	210		40, 655	143, 000	3. 51	152	43	28	223	73	2. 50
Total, excluding wagon mines	3, 977, 631	268, 082	82, 275		4, 327, 988	13, 900, 000	3. 21	6, 966	1, 662	1, 133	9, 761	139	3. 19
Wagon mines served by rail	115, 161				115, 161	375, 000	3. 26						
Grand total	4, 092, 792	268, 082	82, 275		4, 443, 149	14, 275, 000	3. 21						
1924													
Cherokee	729, 718	80, 765	16, 735		827, 218	2, 257, 000	2. 73	683	119	320	1, 122	150	4. 93
Crawford	3, 013, 345	160, 335	49, 069		3, 222, 749	9, 830, 000	3. 05	4, 730	965	729	6, 424	149	3. 37
Leavenworth and Osage	104, 501	65, 219	998		170, 718	687, 000	4. 02	683	146	60	889	174	1. 10
Linn	23, 561	3, 487			27, 048	80, 000	2. 96	86	20	20	126	94	2. 28
Total, excluding wagon mines	3, 871, 125	309, 806	66, 802		4, 247, 733	12, 854, 000	3. 03	6, 182	1, 250	1, 129	8, 561	151	3. 29

KENTUCKY [m]

1923													
Eastern district:													
Bell	2, 575, 670	44, 986	38, 630		2, 659, 286	$6, 820, 000	$2. 56	2, 691	1, 362	786	4, 839	140	3. 94
Boyd	143, 024	5, 840	608		149, 472	298, 000	1. 99	187	53	37	277	207	2. 61
Breathitt	196, 925	11, 515	700		209, 140	470, 000	2. 25	298	129	81	508	131	3. 13
Carter	122, 153	25, 430	277		147, 860	369, 000	2. 50	182	93	63	338	160	2. 74
Clay	180, 583	4, 180	300		185, 063	330, 000	1. 79	197	112	65	374	165	3. 00
Floyd	2, 968, 898	27, 459	39, 014		3, 035, 371	7, 984, 000	2. 63	2, 475	1, 424	860	4, 759	137	4. 66

[k] The number of active mines of commerial size in Iowa was 151 in 1923 and 256 in 1924.

[l] The number of active mines of commercial size in Kansas was 222 in 1923 and 228 in 1924.

[m] The number of active mines of commercial size in eastern Kentucky was 663 in 1923 and 496 in 1924; in western Kentucky it was 172 in 1923 and 164 in 1924; in the State it was 835 in 1923 and 660 in 1924.

TABLE 71.—*Production, value, men employed, days worked, and output per man at coal mines in specified States and counties, 1923–24*—Continued

KENTUCKY—Continued

County	Net tons					Value		Number of employees				Average number of days worked	Average tons per man per day
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Total	Average per ton	Underground		Surface	Total		
								Miners, loaders, and shot firers	All others				
1923—Continued													
Eastern District—Continued.													
Harlan	8, 268, 535	55, 640	46, 756	210, 179	8, 581, 110	$23, 491, 000	$2. 74	4, 951	2, 592	1, 737	9, 230	195	4. 74
Johnson	630, 938	10, 682	17, 691		659, 311	2, 400, 000	3. 64	697	289	186	1, 172	133	4. 23
Knott	340, 389	2, 796			343, 185	827, 000	2. 41	132	63	42	237	206	7. 04
Knox	496, 854	4, 133	9, 967		510, 954	1, 474, 000	2. 88	631	256	209	1, 096	133	3. 50
Laurel	108, 039	353	120		108, 512	257, 000	2. 37	225	74	53	352	126	2. 44
Lawrence	11, 835				11, 835	21, 000	1. 78	52	24	15	91	48	2. 71
Lee	58, 526		486		59, 012	138, 000	2. 34	74	35	21	130	129	3. 52
Letcher	4, 263, 937	50, 931	55, 100		4, 369, 968	12, 527, 000	2. 87	2, 573	1, 243	807	4, 623	167	5. 68
McCreary	862, 772	14, 587	2, 400		879, 759	2, 246, 000	2. 55	877	374	164	1, 415	142	4. 39
Martin	412, 560	590	8, 022		421, 172	944, 000	2. 24	200	115	85	400	161	6. 55
Morgan	25, 088	4, 065	2, 933		32, 086	148, 000	4. 61	105	27	63	195	231	. 71
Perry	4, 990, 754	27, 346	3, 933		5, 022, 033	12, 661, 000	2. 52	3, 300	1, 576	1, 032	5, 908	164	5. 18
Pike	5, 724, 969	69, 915	78, 614	20, 139	5, 893, 637	15, 273, 000	2. 59	3, 474	2, 216	1, 522	7, 212	166	4. 91
Whitley	471, 538	10, 452	15, 687		497, 677	1, 509, 000	2. 53	846	303	220	1, 369	100	3. 62
Other counties ª	2, 310	1, 800			4, 110	11, 000	2. 68	10			10	230	1. 79
Total	32, 856, 297	372, 700	321, 238	230, 318	33, 780, 553	90, 198, 000	2. 66	24, 177	12, 360	8, 048	44, 585	161	4. 70
Western district:													
Christian, Crittenden, and Hancock	31, 284	1, 953	4, 376		37, 613	109, 000	2. 90	181	99	54	334	100	1. 13
Daviess	98, 152	20, 880	950		119, 982	244, 000	2. 03	99	43	28	170	170	4. 16
Henderson	284, 894	68, 988	12, 240		366, 122	866, 000	2. 37	399	178	77	654	130	4. 30
Hopkins	2, 529, 690	140, 455	46, 632		2, 716, 777	5, 437, 000	2. 00	2, 091	871	762	3, 724	124	5. 89
McLean	65, 011	2, 200	729		67, 940	134, 000	1. 97	165	70	66	301	61	3. 68
Muhlenberg	3, 728, 624	180, 051	68, 050		3, 976, 725	8, 249, 000	2. 07	3, 580	1, 620	670	5, 870	125	5. 39
Ohio	943, 993	17, 216	33, 478		994, 687	2, 065, 000	2. 08	1, 152	410	186	1, 748	121	4. 67
Union	1, 188, 215	30, 496	45, 302		1, 264, 013	2, 874, 000	2. 27	904	406	191	1, 501	171	4. 93
Webster	1, 317, 317	9, 155	19, 948		1, 346, 420	3, 045, 000	2. 26	1, 163	489	272	1, 924	120	5. 83
Total	10, 187, 180	471, 394	231, 705		10, 890, 279	23, 023, 000	2. 11	9, 734	4, 186	2, 306	16, 226	127	5. 28
Total all Kentucky, excluding wagon mines	43, 043, 477	844, 094	552, 943	230, 318	44, 670, 832	113, 221, 000	2. 53	33, 911	16, 546	10, 354	60, 811	152	4. 83

Wagon mines served by rail	106, 485				106, 485	321, 000	3. 01						
Grand total	43, 149, 962	844, 094	552, 943	230, 318	44, 777, 317	113, 542, 000	2. 54						
1924													
Eastern district:													
Bell	2, 279, 928	35, 070	15, 859		2, 330, 857	4, 462, 000	1. 91	2, 402	908	584	3, 894	171	3. 51
Boyd	65, 025	3, 018	50		68, 093	177, 000	2. 60	114	61	33	208	156	2. 10
Breathitt	163, 622	6, 728	1, 780		172, 130	306, 000	1. 78	151	69	39	259	180	3. 70
Carter	70, 943	36, 432	73		107, 448	199, 000	1. 85	157	71	40	268	176	2. 28
Clay	184, 767	2, 818	1, 890		189, 475	338, 000	1. 78	253	105	60	418	158	2. 88
Floyd	3, 700, 270	47, 268	53, 630		3, 801, 168	7, 081, 000	1. 86	2, 406	1, 254	732	4, 392	197	4. 39
Harlan	9, 340, 731	64, 431	43, 038	123, 835	9, 572, 035	19, 579, 000	2. 05	5, 183	2, 638	1, 571	9, 392	209	4. 87
Johnson	813, 920	10, 567	17, 337		841, 824	1, 841, 000	2. 19	716	276	183	1, 175	176	4. 08
Knott	340, 509	3, 536			344, 045	598, 000	1. 74	147	66	37	250	185	7. 45
Knox	427, 607	7, 158	8, 596		443, 361	769, 000	1. 73	412	102	99	613	197	3. 67
Laurel	81, 981	2, 600	50		84, 631	162, 000	1. 91	108	37	26	171	212	2. 34
Lee	35, 000	2, 320	1, 000		38, 320	79, 000	2. 06	26	9	15	50	243	3. 16
Letcher	4, 653, 204	61, 839	50, 063		4, 765, 106	8, 620, 000	1. 81	2, 386	1, 216	713	4, 315	209	5. 27
McCreary	827, 715	17, 283	1, 764		846, 762	1, 679, 000	1. 98	796	272	124	1, 192	167	4. 26
Martin	420, 079	2, 519			422, 598	728, 000	1. 72	186	107	69	362	191	6. 11
Morgan	20, 862	3, 160	3, 542		27, 564	101, 000	3. 66	69	22	50	141	235	. 83
Perry	5, 450, 646	76, 068	3, 228		5, 529, 942	9, 886, 000	1. 79	3, 037	1, 447	872	5, 356	207	4. 99
Pike	5, 756, 226	53, 024	63, 522	22, 959	5, 895, 731	10, 602, 000	1. 80	3, 284	1, 981	1, 319	6, 584	193	4. 64
Whitley	604, 439	12, 038	13, 230		629, 707	1, 447, 000	2. 30	817	259	182	1, 258	159	3. 14
Other counties [o]	15, 261	1, 000	75		16, 336	20, 000	1. 22	18	9	9	36	74	6. 13
Total	35, 252, 735	448, 877	278, 727	146, 794	36, 127, 133	68, 674, 000	1. 90	22, 668	10, 909	6, 757	40, 334	195	4. 58
Western district:													
Daviess	73, 270	75, 628	991		149, 889	253, 000	1. 69	148	41	24	213	183	3. 85
Henderson	338, 591	70, 251	18, 769		427, 611	699, 000	1. 63	316	163	61	540	181	4. 38
Hopkins	3, 337, 234	155, 068	59, 506		3, 551, 808	6, 029, 000	1. 70	2, 036	884	846	3, 766	171	5. 53
McLean	45, 757	4, 000	445		50, 202	92, 000	1. 83	74	28	56	158	46	6. 96
Muhlenberg	1, 331, 403	50, 631	20, 747		1, 402, 781	2, 592, 000	1. 85	3, 401	1, 345	592	5, 338	42	6. 19
Ohio	484, 517	10, 560	11, 667		506, 744	925, 000	1. 83	921	313	340	1, 574	59	5. 48
Union	1, 020, 074	27, 648	34, 214		1, 081, 936	2, 026, 000	1. 87	789	443	202	1, 434	178	4. 24
Webster	1, 780, 165	13, 225	33, 139		1, 826, 529	3, 404, 000	1. 86	1, 419	532	282	2, 233	176	4. 65
Other counties [p]	19, 436	3, 135			22, 571	39, 000	1. 73	92	45	39	176	161	. 80
Total	8, 430, 447	410, 146	179, 478		9, 020, 071	16, 059, 000	1. 78	9, 196	3, 794	2, 442	15, 432	115	5. 06
Total all Kentucky, excluding wagon mines	43, 683, 182	859, 023	458, 205	146, 794	45, 147, 204	84, 733, 000	1. 88	31, 864	14, 703	9, 199	55, 766	174	4. 67

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[n] Owsley and Wayne.

[o] Lawrence, Magoffin, and Wayne.

[p] Caldwell, Christian, Crittenden, and Hancock.

TABLE 71.—*Production, value, men employed, days worked, and output per man at coal mines in specified States and counties, 1923–24*—Continued

MARYLAND [a]

County	Net tons					Value		Number of employees				Average number of days worked	Average tons per man per day
								Underground					
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	All others	Surface	Total		
1923													
Allegany	1, 433, 420	62, 512	11, 733		1, 507, 665	$4, 852, 000	$3. 21	1, 563	551	366	2, 480	198	3. 07
Garrett	725, 619	15, 311	14, 682		755, 612	1, 976, 000	2. 62	797	263	185	1, 245	137	4. 42
Total, excluding wagon mines	2, 159, 039	77, 823	26, 415		2, 263, 277	6, 828, 000	3. 02	2, 360	814	551	3, 725	178	3. 42
Wagon mines served by rail	22, 649				22, 649	83, 000	3. 66						
Grand total	2, 181, 688	77, 823	26, 415		2, 285, 926	6, 911, 000	3. 02						
1924													
Allegany	1, 304, 452	157, 214	8, 200		1, 469, 866	3, 522, 000	2. 40	1, 818	639	401	2, 858	169	3. 04
Garrett	640, 807	14, 711	8, 319		663, 837	1, 107, 000	1. 67	555	217	146	918	185	3. 90
Total, excluding wagon mines	1, 945, 259	171, 925	16, 519		2, 133, 703	4, 629, 000	2. 17	2, 373	856	547	3, 776	173	3. 27

MICHIGAN [a]

County	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	All others	Surface	Total	Average number of days worked	Average tons per man per day
1923													
Bay	384, 669	3, 992	15, 342		404, 003	$1, 927, 000	$4. 77	485	246	79	810	231	2. 16
Calhoun and Shiawassee	23, 250	2, 500			25, 750	92, 500	3. 59	8	34	4	46	97	5. 79
Saginaw	678, 129	9, 743	54, 300		742, 172	3, 525, 000	4. 75	720	300	101	1, 121	220	3. 01
Total, excluding wagon mines	1, 086, 048	16, 235	69, 642		1, 171, 925	5, 544, 500	4. 73	1, 213	580	184	1, 977	222	2. 67
Wagon mines served by rail	150				150	500	3. 33						
Grand total	1, 086, 198	16, 235	69, 642		1, 172, 075	5, 545, 000	4. 73						
1924													
Bay	243, 218	3, 833	11, 692		258, 743	1, 159, 000	4. 48	460	199	74	733	139	2. 53
Saginaw	524, 141	2, 600	45, 536		572, 277	2, 443, 000	4. 27	556	191	71	818	212	3. 30
Total, excluding wagon mines	767, 359	6, 433	57, 228		831, 020	3, 602, 000	4. 33	1, 016	390	145	1, 551	178	3. 00

MISSOURI [s]

1923													
Adair	238,846	5,883	7,054	------------	251,783	$744,000	$2.96	369	116	49	534	160	2.95
Audrain	5,558	10,314	87	------------	15,959	62,000	3.88	38	14	6	58	263	1.05
Barton	658,822	6,913	38,355	------------	704,090	2,221,000	3.15	87	14	693	794	93	9.50
Bates	114,245	1,839	3,850	------------	119,934	318,000	2.65	99	23	96	218	130	4.24
Boone and Chariton	------------	12,150	50	------------	12,200	38,000	3.11	32	8	6	46	223	1.19
Caldwell, Clay, Dade, and Platte	60,517	32,277	2,498	------------	95,292	358,000	3.76	189	54	22	265	217	1.66
Callaway	6,800	19,602	200	------------	26,602	110,000	4.13	46	14	7	67	202	1.96
Grundy, Harrison, and Schuyler	3,284	8,426	500	------------	12,210	66,000	5.41	51	12	5	68	133	1.35
Henry	107,600	5,669	1,825	------------	115,094	318,000	2.76	19	3	95	117	170	5.78
Johnson	56,075	1,458	967	------------	58,500	206,000	3.52	49	20	30	99	181	3.26
Lafayette	470,938	23,796	16,543	------------	511,277	1,985,000	3.88	757	303	101	1,161	187	2.38
Linn	5,126	22,674	164	------------	27,964	150,000	5.36	140	66	19	225	76	1.64
Macon	550,348	10,909	10,093	------------	571,350	1,767,000	3.09	764	223	64	1,051	192	2.84
Putnam	12,869	------------	------------	------------	12,869	48,000	3.71	85	24	11	120	363	2.95
Randolph	222,612	6,517	4,400	------------	233,529	796,000	3.41	306	70	38	414	196	2.88
Ray	474,054	41,110	3,469	------------	518,633	2,048,000	3.95	1,126	357	109	1,592	136	2.40
Vernon	7,478	212	134	------------	7,824	21,000	2.68	35	8	9	52	40	3.77
Other counties [t]	17,164	1,698	240	------------	19,102	52,000	2.72	25	6	40	71	135	2.00
Total, excluding wagon mines	3,012,336	211,447	90,429	------------	3,314,212	11,308,000	3.41	4,217	1,335	1,400	6,952	155	3.07
Wagon mines served by rail	88,939	------------	------------	------------	88,939	267,000	3.00	------------	------------	------------	------------	------------	------------
Grand total	3,101,275	211,447	90,429	------------	3,403,151	11,575,000	3.40	------------	------------	------------	------------	------------	------------
1924													
Adair	123,193	26,082	5,020	------------	154,295	474,000	3.07	218	111	24	353	138	3.17
Audrain	3,921	12,877	122	------------	16,920	69,000	4.08	36	13	4	53	264	1.21
Barton	702,690	5,440	31,724	------------	739,854	2,170,000	2.93	33	10	636	679	122	8.96
Bates	198,220	2,002	7,625	------------	207,847	518,000	2.49	103	22	102	227	146	6.25
Boone, Chariton, and Callaway	600	18,738	------------	------------	19,338	65,000	3.36	43	8	7	58	176	1.87
Caldwell, Clay, and Platte	51,279	45,590	2,756	------------	99,625	472,000	4.74	194	79	24	297	182	1.84
Grundy, Harrison, and Schuyler	2,050	7,904	237	------------	10,191	52,000	5.10	40	12	6	58	151	1.16
Henry	101,300	9,605	826	------------	111,731	322,000	2.88	21	3	99	123	192	4.73
Lafayette	277,635	39,163	9,699	------------	326,497	1,238,000	3.79	865	273	101	1,239	124	2.12
Linn	2,699	19,027	103	------------	21,829	104,000	4.76	72	18	12	102	111	1.92
Macon	170,533	9,519	1,546	------------	181,598	559,000	3.08	594	159	59	812	101	2.21
Putnam	8,547	------------	------------	------------	8,547	26,000	3.04	47	9	5	61	89	1.56
Randolph	128,289	6,070	3,865	------------	138,224	446,000	3.23	328	55	37	420	144	2.29
Ray	363,639	41,504	3,059	------------	408,202	1,529,000	3.75	993	277	132	1,402	146	1.99
Other counties [u]	34,560	781	841	------------	36,182	110,000	3.04	62	19	12	93	135	2.88
Total, excluding wagon mines	2,169,155	244,302	67,423	------------	2,480,880	8,154,000	3.29	3,649	1,068	1,260	5,977	135	3.08

[q] The number of active mines of commercial size in Maryland was 105 in 1923 and 93 in 1924.

[r] The number of active mines of commercial size in Michigan was 13 in 1923 and 9 in 1924.

[s] The number of active mines of commercial size in Missouri was 149 in 1923 and 127 in 1924.

[t] Cass, Lincoln, Ralls, and St. Clair.

[u] Johnson, Ralls, and Vernon.

TABLE 71.—*Production, value, men employed, days worked, and output per man at coal mines in specified States and counties, 1923–24*—Continued

MONTANA [v]

County	Net tons					Value		Number of employees				Average number of days worked	Average tons per man per day
								Underground					
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	All others	Surface	Total		
1923													
Blaine	1, 702	14, 225	150		16, 077	$39, 000	$2. 43	15	4	4	23	225	3. 10
Carbon	1, 258, 107	35, 988	72, 875		1, 366, 970	4, 641, 000	3. 40	858	382	274	1, 514	196	4. 60
Cascade	662, 170	31, 957	11, 402		705, 529	1, 969, 000	2. 79	507	201	133	841	168	4. 98
Musselshell	993, 747	6, 329	10, 362		1, 010, 438	2, 855, 000	2. 83	609	312	129	1, 050	163	5. 98
Sheridan	200	8, 534			8, 734	30, 000	3. 43	15			15	179	3. 26
Other counties [w]	15, 572	21, 027			36, 599	108, 000	2. 95	50	11	7	68	207	2. 61
Total, excluding wagon mines	2, 931, 498	118, 060	94, 789		3, 144, 347	9, 642, 000	3. 07	2, 054	910	547	3, 511	179	4. 99
Wagon mines served by rail	3, 331				3, 331	10, 000	2. 92						
Grand total	2, 934, 829	118, 060	94, 789		3, 147, 678	9, 652, 000	3. 07						
1924													
Carbon	987, 939	43, 790	57, 485		1, 089, 214	3, 742, 000	3. 44	733	338	225	1, 296	175	4. 80
Cascade	499, 836	28, 938	9, 865		538, 639	1, 417, 000	2. 63	447	165	119	731	150	4. 90
Fergus		3, 800			3, 800	15, 000	3. 95	4	3	3	10	187	2. 03
Musselshell	946, 847	14, 890	13, 944		975, 681	2, 586, 000	2. 65	550	278	111	939	177	5. 88
Richland	18, 618	10, 806			29, 424	113, 000	3. 84	24	20	7	51	229	2. 52
Sheridan	300	11, 659			11, 959	28, 000	2. 34	18	2	2	22	178	3. 05
Other counties [x]	197, 296	56, 707	2, 645		256, 648	695, 000	2. 71	76	17	54	147	219	7. 98
Total, excluding wagon mines	2, 650, 836	170, 590	83, 939		2, 905, 365	8, 596, 000	2. 96	1, 852	823	521	3, 196	173	5. 23

NEW MEXICO [y]

County	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Value: Total	Value: Average per ton	Miners, loaders, and shot firers	All others	Surface	Total	Average number of days worked	Average tons per man per day
1923													
Colfax	1, 514, 968	17, 305	6, 430	257, 335	1, 796, 038	$6, 334, 000	$3. 53	1, 408	623	281	2, 312	203	3. 82
McKinley	783, 687	10, 482	27, 246		821, 415	2, 996, 000	3. 65	766	270	183	1, 219	225	2. 99
Rio Arriba	32, 032	87	1, 100		33, 219	98, 000	2. 95	41	9	6	56	289	2. 06

San Juan	88	3, 972	-----	-----	4, 060	9, 000	2. 22	6	1	1	8	185	2. 75
Other counties [z]	224, 951	6, 838	11, 913	-----	243, 702	1, 179, 000	4. 84	301	122	77	500	146	1. 99
Total, excluding wagon mines	2, 555, 726	38, 684	46, 689	257, 335	2, 898, 434	10, 616, 000	3. 66	2, 522	1, 025	548	4, 095	216	3. 28
Wagon mines served by rail	16, 739	-----	-----	-----	16, 739	52, 000	3. 11	-----	-----	-----	-----	-----	-----
Grand total	2, 572, 465	38, 684	46, 689	257, 335	2, 915, 173	10, 668, 000	3. 66	-----	-----	-----	-----	-----	-----
1924													
Colfax	1, 478, 975	15, 666	13, 758	136, 212	1, 644, 611	5, 480, 000	3. 33	1, 223	486	661	2, 370	190	3. 66
McKinley	844, 377	20, 869	24, 581	-----	889, 827	3, 241, 000	3. 64	868	265	174	1, 307	214	3. 18
Rio Arriba	31, 020	42	600	-----	31, 662	95, 000	3. 00	29	7	9	45	238	2. 96
San Juan	-----	4, 414	-----	-----	4, 414	9, 000	2. 04	6	1	-----	7	224	2. 81
Other counties [a]	195, 066	8, 010	12, 473	-----	215, 549	949, 000	4. 40	290	92	95	477	241	1. 87
Total, excluding wagon mines	2, 549, 438	49, 001	51, 412	136, 212	2, 786, 063	9, 774, 000	3. 51	2, 416	851	939	4, 206	204	3. 25

NORTH DAKOTA (LIGNITE) [b]

1923													
Adams	66, 253	6, 035	3, 426	-----	75, 714	$184, 000	$2. 43	62	16	16	94	154	5. 24
Burke	217, 561	12, 289	9, 480	-----	239, 330	532, 000	2. 22	14	7	124	145	214	7. 72
Burleigh	221, 633	13, 191	8, 862	-----	243, 686	589, 000	2. 42	174	67	47	288	163	5. 20
Divide	44, 586	5, 575	-----	-----	50, 161	122, 000	2. 43	28	8	15	51	184	5. 33
Dunn	10, 771	3, 756	-----	-----	14, 527	29, 000	1. 99	14	3	6	23	184	3. 43
Grant	5, 035	5, 139	-----	-----	10, 174	22, 000	2. 16	29	6	7	42	126	1. 93
Hettinger	8, 699	7, 314	200	-----	16, 213	35, 000	2. 16	32	8	9	49	119	2. 78
McLean	85, 725	31, 779	2, 688	-----	120, 192	293, 000	2. 43	75	16	73	164	206.	3. 55
Mercer	209, 627	2, 950	7, 580	-----	220, 157	534, 000	2. 43	96	40	93	229	182.	5. 28
Morton	35, 117	30, 517	400	-----	66, 034	131, 000	1. 98	47	13	18	78	184.	4. 59
Mountrail	-----	1, 722	-----	-----	1, 722	3, 000	1. 74	20	-----	-----	20	170	1. 59
Stark	49, 523	17, 615	2, 523	-----	69, 661	168, 000	2. 41	50	23	20	93	216	3. 47
Ward	37, 664	36, 585	71	-----	74, 320	188, 000	2. 53	109	16	18	143	193	2. 69
Williams	43, 254	38, 006	278	-----	81, 538	205, 000	2. 52	81	24	17	122	167	3. 98
Other counties [c]	64, 424	6, 101	3, 000	-----	73, 525	176, 000	2. 39	52	10	18	80	236	3. 89
Total, excluding wagon mines	1, 099, 872	218, 574	38, 508	-----	1, 356. 954	3, 211, 000	2. 37	883	257	481	1, 621	182	4. 60
Wagon mines served by rail	28, 446	-----	-----	-----	28, 446	64, 000	2. 25	-----	-----	-----	-----	-----	-----
Grand total	1, 128, 318	218, 574	38, 508	-----	1, 385, 400	3, 275, 000	2. 36	-----	-----	-----	-----	-----	-----

[v] The number of active mines of commercial size in Montana was 48 in 1923 and 68 in 1924.

[w] Chouteau, Gallatin, Hill, Pondera, Richland, Roosevelt, and Toole.

[x] Blaine, Chouteau, Custer, Dawson, Gallatin, Hill, Judith Basin, Pondera, Rosebud, Toole, and Wibaux.

[y] The number of active mines of commercial size in New Mexico was 42 in both 1923 and 1924.

[z] Lincoln, Santa Fe, and Socorro.

[a] Lincoln, Sandoval, Santa Fe, and Socorro.

[b] The number of active mines of commercial size in North Dakota was 144 in 1923, and 132 in 1924; all coal produced in North Dakota is lignite.

[c] Billings, Bowman, and Oliver.

TABLE 71.—*Production, value, men employed, days worked, and output per man at coal mines in specified States and counties, 1923–24*—Continued

NORTH DAKOTA (LIGNITE)—Continued

County	Net tons					Value		Number of employees				Average number of days worked	Average tons per man per day
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Total	Average per ton	Underground		Surface	Total		
								Miners, loaders, and shot firers	All others				
1924													
Adams	36, 975	6, 856	1, 084		44, 915	$102, 000	$2. 27	33	13	10	56	163	4. 93
Bowman	20, 679	6, 207	3, 600		30, 486	53, 000	1. 74	24	6	8	38	197	4. 07
Burke	299, 779	5, 424	5, 476		310, 679	684, 000	2. 20			156	156	149	13. 38
Burleigh	115, 592	13, 204	6, 134		134, 930	283, 000	2. 10	124	38	43	205	117	5. 64
Divide	29, 053	7, 960			37, 013	80, 000	2. 16	31	7	9	47	149	5. 30
Grant	40	5, 995			6, 035	13, 000	2. 15	4	4	2	10	186	3. 25
Hettinger	18, 404	7, 212	435		26, 051	56, 000	2. 15	38	9	13	60	166	2. 62
McLean	65, 486	24, 532	1, 351		91, 369	205, 000	2. 24	59	13	41	113	156	5. 20
Mercer	255, 532	3, 599	6, 787		265, 918	517, 000	1. 94	110	35	96	241	198	5. 56
Morton	21, 216	24, 702	2, 147		48, 065	87, 000	1. 81	29	6	13	48	237	4. 23
Mountrail		3, 286			3, 286	9, 400	2. 86	7			7	141	3. 32
Stark	30, 202	21, 358	1, 940		53, 500	84, 000	1. 57	46	20	18	84	143	4. 46
Ward	24, 385	35, 793			60, 17	131, 000	2. 18	72	14	15	101	205	2. 91
Williams	21, 816	41, 244	492		63, 552	121, 000	1. 90	66	16	9	91	162	4. 30
Other counties [d]	18, 828	5, 622	100		24, 550	47, 600	1. 94	28	5	8	41	147	4. 09
Total, excluding wagon mines	957, 987	212, 994	29, 546		1, 200, 527	2, 473, 000	2. 06	671	186	441	1, 298	165	5. 62

OHIO

County	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Value: Total	Value: Average per ton	Miners, loaders, and shot firers	All others	Surface	Total	Average number of days worked	Average tons per man per day
1923													
Athens	4, 133, 625	76, 744	74, 959		4, 285, 328	$10, 315, 000	$2. 41	5, 765	1, 786	930	8, 481	109	4. 64
Belmont	12, 689, 439	406, 506	99, 185		13, 195, 130	31, 100, 000	2. 36	8, 327	3, 076	1, 390	12, 793	193	5. 34
Carroll	353, 394	85, 172	20, 496		459, 062	1, 204, 000	2. 62	362	129	64	555	202	4. 09
Columbiana	863, 307	55, 169	23, 266		941, 742	2, 747, 000	2. 92	686	241	241	1, 168	187	4. 31
Coshocton	213, 433	14, 464	3, 179		231, 076	655, 000	2. 83	404	143	76	623	103	3. 60
Guernsey	3, 070, 277	167, 833	81, 127		3, 319, 237	8, 240, 000	2. 48	2, 784	1, 246	391	4, 421	144	5. 21
Harrison	2, 695, 323	17, 249	53, 382		2, 765, 954	6, 168, 000	2. 23	1, 220	424	1, 032	2, 676	145	7. 09

Hocking	1,016,931	72,235	9,481	------	1,098,647	2,688,000	2.44	1,753	459	302	2,514	98	4.47
Holmes	250	2,725	------	------	2,975	8,000	2.81	8	------	------	8	148	2.51
Jackson	194,413	59,636	11,397	------	265,446	840,000	3.15	777	285	157	1,219	66	3.32
Jefferson	5,739,482	691,365	76,163	------	6,507,010	16,069,000	2.47	3,769	1,568	1,559	6,896	188	5.00
Lawrence	25,665	114,783	343	------	140,791	348,000	2.47	269	71	42	382	121	3.05
Mahoning	476	46,874	12	------	47,362	174,000	3.67	65	10	7	82	190	3.04
Medina	------	10,485	400	------	10,885	61,000	5.60	15	4	3	22	235	2.10
Meigs	1,166,420	26,926	23,983	------	1,217,329	3,141,000	2.57	1,847	694	333	2,874	114	3.70
Morgan, Scioto, and Washington	211,559	3,552	3,745	------	218,856	530,000	2.42	283	103	49	435	126	4.00
Muskingum	411,826	65,205	3,594	------	480,625	1,121,000	2.33	537	123	170	830	141	4.12
Noble	690,169	9,482	19,269	------	718,920	1,798,000	2.50	513	308	83	904	156	4.62
Perry	2,430,799	53,419	54,733	------	2,538,951	5,762,000	2.27	2,519	777	797	4,093	122	5.07
Portage, Summit, and Wayne	80,027	21,624	16,803	------	118,454	475,000	4.01	136	50	43	229	159	3.25
Stark	127,185	311,249	5,128	------	443,562	1,345,000	3.03	406	109	74	589	206	3.65
Tuscarawas	977,253	356,332	16,739	------	1,350,324	3,311,000	2.45	1,382	507	382	2,271	131	4.55
Vinton	90,965	3,239	2,905	------	97,109	238,000	2.45	294	112	84	490	81	2.44
Total, excluding wagon mines	37,182,218	2,672,268	600,289	------	40,454,775	98,338,000	2.43	34,121	12,225	8,209	54,555	150	4.96
Wagon mines served by rail	91,668	------	------	------	91,668	272,000	2.97	------	------	------	------	------	------
Grand total	37,273,886	2,672,268	600,289	------	40,546,443	98,610,000	2.43	------	------	------	------	------	------
1924													
Athens	2,905,252	66,770	52,893	------	3,024,915	5,843,000	1.93	5,273	1,425	692	7,390	101	4.03
Belmont	10,425,106	415,433	93,571	------	10,934,110	21,928,000	2.01	8,784	2,369	1,112	12,265	182	4.90
Carroll	183,802	107,379	4,575	------	295,756	664,000	2.25	307	106	63	476	151	4.11
Columbiana	323,111	40,016	5,811	------	368,938	879,000	2.38	529	221	116	866	103	4.14
Coshocton	151,894	36,035	1,599	------	189,528	446,000	2.35	290	94	50	434	122	3.59
Guernsey	2,436,503	139,510	61,192	------	2,637,205	5,591,000	2.12	2,460	1,036	271	3,767	141	4.95
Harrison	2,464,261	9,512	60,907	------	2,534,680	4,346,000	1.71	705	229	945	1,879	144	9.33
Hocking	682,140	71,766	2,306	------	756,212	1,355,000	1.79	1,055	275	201	1,531	107	4.61
Holmes	------	18,428	40	------	18,468	49,000	2.65	27	5	3	35	188	2.80
Jackson	81,824	67,156	4,410	------	153,390	404,000	2.63	321	111	60	492	96	3.24
Jefferson	3,801,751	576,086	25,145	------	4,402,982	9,412,000	2.14	3,655	1,244	845	5,744	153	5.01
Lawrence	2,417	108,579	179	------	111,175	218,000	1.96	124	37	14	175	221	2.87
Mahoning	286	43,906	60	------	44,252	149,000	3.37	67	10	8	85	177	2.95
Medina, Portage, and Summit	63,183	18,307	10,897	------	92,387	336,000	3.64	85	40	34	159	209	2.78
Meigs	184,595	47,399	2,420	------	234,414	457,000	1.95	952	286	137	1,375	42	4.07
Morgan, Noble, Scioto, and Washington	652,215	9,338	15,210	------	676,763	1,394,000	2.06	640	343	83	1,066	157	4.05
Muskingum	325,766	68,901	5,167	------	399,834	828,000	2.07	420	90	176	686	123	4.72
Perry	1,831,848	73,182	23,809	------	1,928,839	3,819,000	1.98	2,034	567	639	3,240	128	4.64
Stark	118,225	304,451	5,406	------	428,082	1,190,000	2.78	426	106	83	615	194	3.59
Tuscarawas	699,264	434,265	4,568	------	1,138,097	2,476,000	2.18	1,115	313	212	1,640	162	4.28
Vinton	65,308	24,110	1,892	------	91,310	181,000	1.98	170	55	36	261	98	3.58
Wayne	6,200	5,036	434	------	11,670	46,000	3.94	42	4	2	48	108	2.26
Total, excluding wagon mines	27,404,951	2,685,565	382,491	------	30,473,007	62,011,000	2.03	29,481	8,966	5,782	44,229	143	4.82

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[d] Billings, Dunn, Golden Valley, and Oliver.

[e] The number of active mines of commercial size in Ohio was 906 in 1923 and 750 in 1924.

TABLE 71.—*Production, value, men employed, days worked, and output per man at coal mines in specified States and counties, 1923–24*—Continued

OKLAHOMA [f]

County	Net tons					Value		Number of employees				Average number of days worked	Average tons per man per day
								Underground					
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	All others	Surface	Total		
1923													
Coal	30,400	1,884	1,180		33,464	$149,000	$4.46	84	42	18	144	108	2.14
Haskell	121,882	1,692	7,121		130,695	503,000	3.85	81	41	86	208	176	3.57
Latimer	127,463	851	8,830		137,144	567,000	4.14	365	167	93	625	72	3.05
Le Flore	187,061	12,014	8,201	7,631	214,907	855,000	3.98	491	230	152	873	103	2.40
Okmulgee	803,092	1,972	12,986		818,050	2,719,000	3.32	1,336	496	230	2,062	97	4.09
Pittsburg	1,154,920	10,434	76,589		1,241,943	5,011,000	4.03	1,616	909	285	2,810	174	2.53
Tulsa	190,074	5,705	2,115		197,894	702,000	3.55	95	29	169	293	191	3.54
Other counties [g]	62,807	3,446			66,253	223,000	3.36	32	16	67	115	146	3.93
Total, excluding wagon mines	2,677,699	37,998	117,022	7,631	2,840,350	10,729,000	3.77	4,100	1,930	1,100	7,130	133	2.99
Wagon mines served by rail	44,688				44,688	145,000	3.25						
Grand total	2,722,387	37,998	117,022	7,631	2,885,038	10,874,000	3.77						
Coal	27,011	1,340	898		29,249	136,000	4.65	72	33	28	133	96	2.28
Haskell	67,426	1,876	3,545		72,847	364,000	5.00	25	8	92	125	151	3.86
Latimer	238,739	1,363	13,922		254,024	945,000	3.72	477	206	120	803	138	2.29
Le Flore	145,157	12,991	4,991		163,139	652,000	4.00	354	169	93	616	96	2.77
Okmulgee	814,380	752	3,551		818,683	2,514,000	3.07	1,032	379	186	1,597	118	4.34
Pittsburg	683,290	4,732	29,772		717,794	3,061,000	4.26	1,337	936	286	2,559	122	2.31
Tulsa	166,217	10,759			176,976	611,000	3.45	26	8	146	180	222	4.44
Other counties [g]	94,717	2,186			96,903	307,000	3.17	1	1	129	131	174	4.25
Total, excluding wagon mines	2,236,937	35,999	56,679		2,329,615	8,590,000	3.69	3,324	1,740	1,080	6,144	124	3.05

PENNSYLVANIA (BITUMINOUS) [h]

1923												
Allegheny	18, 198, 211	1, 866, 052	159, 976	------------	20, 224, 239	$54, 521, 000	$2. 70	13, 495	4, 344	2, 788	20, 627	233	4. 20
Armstrong	4, 651, 674	262, 491	147, 567	------------	5, 061, 732	13, 710, 000	2. 71	4, 844	1, 275	1, 038	7, 157	172	4. 11
Beaver	166, 820	55, 700	24, 551	------------	247, 071	694, 000	2. 80	199	37	99	335	220	3. 35
Bedford	431, 760	16, 864	13, 521	135, 351	597, 496	1, 849, 000	3. 09	835	303	142	1, 280	148	3. 16
Blair	109, 682	22, 184	2, 023	35, 387	169, 276	516, 000	3. 05	226	40	36	302	169	3. 32
Bradford	9, 315	865	150	------------	10, 330	36, 000	3. 48	13	4	13	30	158	2. 19
Butler	1, 765, 161	66, 276	24, 882	------------	1, 856, 319	4, 991, 000	2. 69	1, 949	606	422	2, 977	177	3. 51
Cambria	16, 627, 417	2, 641, 876	191, 671	290, 501	19, 751, 465	59, 213, 000	3. 00	16, 467	4, 811	2, 874	24, 152	197	4. 14
Center	1, 292, 977	62, 247	1, 279	------------	1, 356, 503	3, 897, 000	2. 87	1, 638	403	244	2, 285	162	3. 65
Clarion	1, 792, 996	93, 290	14, 263	------------	1, 900, 549	4, 726, 000	2. 49	2, 007	507	375	2, 889	193	3. 40
Clearfield	6, 977, 477	274, 436	101, 429	192, 716	7, 546, 058	20, 939, 000	2. 77	8, 845	2, 250	1, 497	12, 592	166	3. 62
Clinton	209, 037	47, 650	3, 864	------------	260, 551	642, 000	2. 46	156	59	93	308	205	4. 13
Elk	1, 089, 871	18, 423	38, 831	------------	1, 147, 125	3, 385, 000	2. 95	1, 430	256	232	1, 918	193	3. 11
Fayette	15, 121, 722	389, 108	691, 877	15, 963, 254	32, 165, 961	89, 307, 000	2. 78	13, 887	11, 549	5, 897	31, 333	248	4. 15
Greene	3, 808, 070	27, 595	50, 847	95, 491	3, 982, 003	10, 829, 000	2. 72	1, 758	1, 364	724	3, 846	258	4. 01
Huntingdon	711, 901	10, 478	21, 803	13, 496	757, 678	2, 798, 000	3. 69	1, 010	264	108	1, 382	198	2. 77
Indiana	9, 764, 471	209, 069	86, 245	415, 514	10, 475, 299	28, 521, 000	2. 72	8, 847	2, 515	1, 699	13, 061	192	4. 17
Jefferson	3, 649, 007	85, 436	92, 805	554, 445	4, 381, 693	11, 851, 000	2. 71	3, 995	1, 061	685	5, 741	191	4. 00
Lawrence	218, 927	52, 960	9, 821	------------	281, 708	905, 000	3. 21	241	85	44	370	282	2. 70
Mercer	430, 098	13, 167	22, 084	------------	465, 349	1, 409, 000	3. 03	597	191	113	901	178	2. 91
Somerset	8, 207, 293	194, 418	128, 907	------------	8, 530, 618	25, 379, 000	2. 97	7, 827	2, 527	1, 766	12, 120	185	3. 80
Tioga	437, 736	34, 384	8, 215	------------	480, 335	1, 813, 000	3. 77	773	164	148	1, 085	192	2. 31
Washington	23, 520, 756	286, 865	232, 276	459, 206	24, 499, 103	61, 406, 000	2. 51	15, 436	5, 264	3, 075	23, 775	220	4. 68
Westmoreland	18, 765, 751	622, 787	437, 353	5, 582, 979	25, 408, 870	67, 706, 000	2. 66	13, 824	6, 276	4, 290	24, 390	235	4. 42
Other counties [i]	78, 046	4, 592	987	------------	83, 625	326, 000	3. 90	86	28	11	125	229	2. 91
Total, excluding wagon mines	138, 036, 176	7, 359, 213	2, 507, 227	23, 738, 340	171, 640, 956	471, 369, 000	2. 74	120, 385	46, 183	28, 413	194, 981	213	4. 14
Wagon mines served by rail	238, 957	------------	------------	------------	238, 957	848, 000	3. 55	----------	--------	--------	--------	----------	----------
Grand total	138, 275, 133	7, 359, 213	2, 507, 227	23, 738, 340	171, 879, 913	472, 217, 000	2. 75	----------	--------	--------	--------	----------	----------
1924													
Allegheny	12, 658, 439	1, 716, 678	122, 708	------------	14, 497, 825	33, 090, 000	2. 28	12, 914	3, 643	2, 194	18, 751	187	4. 12
Armstrong	3, 336, 434	191, 291	105, 894	------------	3, 633, 619	7, 446, 000	2. 05	3, 985	924	753	5, 662	146	4. 39
Beaver	176, 582	59, 875	306	------------	236, 763	503, 000	2. 12	154	27	100	281	214	3. 93
Bedford	230, 884	13, 214	7, 900	28, 195	280, 193	772, 000	2. 76	726	216	117	1, 059	78	3. 39
Blair	36, 219	22, 795	729	11, 944	71, 687	174, 000	2. 43	221	45	35	301	104	2. 28
Bradford	3, 413	740	------------	------------	4, 153	12, 000	2. 89	13	3	3	19	94	2. 31
Butler	1, 292, 007	43, 236	17, 111	------------	1, 352, 354	2, 877, 000	2. 13	1, 489	421	343	2, 253	168	3. 56
Cambria	14, 307, 443	2, 031, 476	165, 097	135, 652	16, 639, 668	42, 050, 000	2. 53	16, 219	4, 326	2, 316	22, 861	178	4. 08
Center	748, 890	65, 156	650	------------	814, 696	1, 936, 000	2. 38	1, 127	283	186	1, 596	204	4. 27
Clarion	1, 169, 429	124, 090	4, 868	------------	1, 298, 387	2, 655, 000	2. 04	1, 615	400	257	2, 272	179	3. 19
Clearfield	4, 931, 916	241, 647	76, 573	60, 868	5, 311, 004	11, 984, 000	2. 26	7, 270	1, 771	1, 167	10, 208	149	3. 49

[f] The number of active mines of commercial size in Oklahoma was 115 in 1923 and 94 in 1924.
[g] Craig, Muskogee, Rogers, and Wagoner.
[h] The number of active bituminous coal mines of commercial size in Pennsylvania was 2,868 in 1923 and 2,122 in 1924.
[i] Cameron, Fulton, Lycoming, and McKean.

Table 71.—*Production, value, men employed, days worked, and output per man at coal mines in specified States and counties, 1923–24*—Continued

PENNSYLVANIA (BITUMINOUS)—Continued

County	Net tons					Value		Number of employees				Average number of days worked	Average tons per man per day
								Underground					
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	All others	Surface	Total		
1924—Continued													
Clinton	276, 389	19, 808	3, 729		299, 926	$598, 000	$1. 99	134	48	140	322	235	3. 97
Elk	1, 083, 618	18, 674	35, 277		1, 137, 569	2, 842, 000	2. 50	1, 321	227	181	1, 729	213	3. 08
Fayette	16, 252, 397	260, 188	515, 149	8, 404, 399	25, 432, 133	57, 081, 000	2. 24	11, 873	9, 571	4, 235	25, 679	207	4. 78
Greene	3, 602, 335	33, 446	48, 630	63, 118	3, 747, 529	7, 680, 000	2. 05	1, 587	1, 129	638	3, 354	237	4. 71
Huntingdon	727, 195	14, 808	21, 854		763, 857	1, 940, 000	2. 54	1, 001	271	128	1, 400	207	2. 64
Indiana	6, 504, 277	206, 370	44, 132	287, 805	7, 042, 584	15, 923, 000	2. 26	8, 441	2, 069	1, 435	11, 945	145	4. 06
Jefferson	2, 504, 377	68, 869	49, 587	321, 243	2, 944, 076	6, 559, 000	2. 23	3, 543	891	579	5, 013	159	3. 70
Lawrence	183, 785	37, 966	12, 412		234, 163	788, 000	3. 37	249	91	54	394	229	2. 59
Mercer	274, 273	10, 565	15, 231		300, 069	910, 000	3. 03	389	128	78	595	182	2. 77
Somerset	8, 173, 394	154, 864	108, 478		8, 436, 736	18, 118, 000	2. 15	7, 272	2, 094	1, 525	10, 891	191	4. 06
Tioga	251, 726	35, 462	5, 910		293, 098	961, 000	3. 28	672	151	146	969	120	2. 51
Washington	17, 338, 959	427, 558	121, 045	50, 278	17, 937, 840	39, 050, 000	2. 18	14, 220	4, 524	2, 491	21, 235	186	4. 53
Westmoreland	14, 064, 798	758, 852	350, 653	2, 628, 348	17, 802, 651	38, 907, 000	2. 19	12, 195	5, 024	3, 114	20, 333	181	4. 84
Other counties [i]	111, 642	8, 108	1, 443		121, 193	308, 000	2. 54	143	35	22	200	262	2. 31
Total, excluding wagon mines	110, 240, 821	6, 565, 736	1, 835, 366	11, 991, 850	130, 633, 773	295, 164, 000	2. 26	108, 773	38, 312	22, 237	169, 322	180	4. 27

SOUTH DAKOTA (LIGNITE) [k]

County	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	All others	Surface	Total	Average number of days worked	Average tons per man per day
1923													
Dewey and Harding	2, 000	325			2, 325	$6, 000	$2. 58	8			8	91	3. 19
Meade and Ziebach		586			586	2, 000	3. 41	5			5	75	1. 56
Perkins		7, 468			7, 468	17, 000	2. 28	21			21	146	2. 44
	2, 000	8, 279			10, 379	25, 000	2. 41	34			34	122	2. 50

1924													
Harding and Ziebach	3,000	819			3,819	12,200	3.19	11			11	168	2.07
Meade		1,539			1,539	6,900	4.48	12			12	119	1.08
Perkins		6,685			6,685	16,900	2.53	17			17	131	3.00
	3,000	9,043			12,043	36,000	2.99	40			40	138	2.18
TENNESSEE [l]													
1923													
Anderson	582,155	9,694	14,251		606,100	$1,419,000	$2.34	780	283	209	1,272	161	2.97
Campbell	1,207,298	37,253	19,068		1,263,619	3,798,000	3.00	1,570	615	384	2,569	188	2.61
Claiborne	1,146,707	12,808	17,987		1,177,502	3,176,000	2.70	892	379	238	1,509	182	4.29
Cumberland	16,870	272	579		17,721	40,000	2.26	26	14	11	51	167	2.09
Fentress	346,218	5,558	8,255		360,031	908,000	2.52	290	121	85	496	173	4.20
Grundy	445,614	3,196	2,998	52,979	504,787	1,478,000	2.93	806	237	207	1,250	159	2.54
Hamilton	332,314	5,280	12,530		350,124	1,012,000	2.89	357	201	103	661	192	2.76
Marion	184,303	1,595	5,636		191,534	549,000	2.87	206	84	61	351	227	2.40
Morgan	379,810	3,724	10,372	28,500	422,406	892,000	2.11	552	275	129	956	186	2.37
Overton	177,562	1,765	1,664		180,991	508,000	2.81	203	45	43	291	157	3.96
Roane	6,209	3,315	6,895	109,232	125,651	416,000	3.31	118	133	41	292	235	1.83
Scott	139,783	8,073	935		148,791	391,000	2.62	249	83	71	403	128	2.89
Other counties [m]	638,174	27,124	14,613		679,911	1,895,000	2.79	703	263	177	1,143	218	2.72
Total, excluding wagon mines	5,603,017	119,657	115,783	190,711	6,029,168	16,482,000	2.73	6,752	2,733	1,759	11,244	183	2.93
Wagon mines served by rail	11,100				11,100	33,000	3.00						
Grand total	5,614,117	119,657	115,783	190,711	6,040,268	16,515,000	2.73						
1924													
Anderson	647,079	10,385	14,330		671,794	1,187,000	1.77	670	290	146	1,106	158	3.85
Campbell	941,960	18,464	31,165	61,707	1,053,296	2,297,000	2.18	1,374	460	335	2,169	172	2.83
Claiborne	848,309	8,921	14,448		871,678	1,931,000	2.22	776	321	213	1,310	148	4.50
Fentress	250,204	8,885	4,965		264,054	527,000	2.00	318	80	56	454	158	3.69
Grundy	219,719	1,015	995	9,311	231,040	608,000	2.63	481	91	75	647	122	2.93
Hamilton	109,492	3,877	7,487		120,856	290,000	2.40	277	92	76	445	119	2.28
Marion	202,038	3,003	5,918		210,959	512,000	2.43	367	106	122	595	158	2.25
Morgan	265,047	1,951	10,320	36,900	314,218	582,000	1.85	399	248	102	749	172	2.44
Overton	121,455	800	927		123,182	246,000	2.00	159	45	42	246	132	3.80
Roane	870	1,916	5,204	122,283	130,273	360,000	2.76	107	144	38	289	294	1.53
Scott	171,950	4,891	4,501		181,342	275,000	1.52	205	105	64	374	169	2.87
Other counties [n]	364,750	9,592	9,521		383,863	896,000	2.33	593	254	134	981	149	2.62
Total, excluding wagon mines	4,142,873	73,700	109,781	230,201	4,556,555	9,711,000	2.13	5,726	2,236	1,403	9,365	159	3.05

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[j] Fulton, Lycoming, McKean, and Venango.

[k] All coal produced in South Dakota is lignite.

[l] The number of active mines of commercial size in Tennessee was 191 in 1923 and 139 in 1924.

[m] Bledsoe, Rhea, Sequatchie, and White.

[n] Bledsoe, Cumberland, Putnam, Rhea, Sequatchie, and White.

TABLE 71.—*Production, value, men employed, days worked, and output per man at coal mines in specified States and counties, 1923–24*—Continued

TEXAS

County	Net tons					Value		Number of employees				Average number of days worked	Average tons per man per day
								Underground					
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	All others	Surface	Total		
1923													
Erath, Maverick, Palo Pinto, Webb, and Wise, bituminous coal	163, 436	2, 025	9, 871	------------	175, 332	$836, 000	$4. 77	652	141	122	915	131	1. 47
Anderson, Bastrop, Bexar, Henderson, Hopkins, Houston, Lee, Leon, Milam, Nacogdoches, Shelby, Titus, and Wood, lignite	993, 465	4, 539	13, 993	------------	1, 011, 997	1, 326, 000	1. 31	989	352	196	1, 537	206	3. 19
Total, excluding wagon mines	1, 156, 901	6, 564	23, 864	------------	1, 187, 329	2, 162, 000	1. 82	1, 641	493	318	2, 452	178	2. 72
1924													
Erath, Maverick, Palo Pinto, Webb, and Wise, bituminous coal	151, 718	3, 057	8, 421	------------	163, 196	633, 000	3. 88	473	137	120	730	148	1. 51
Anderson, Bastrop, Bexar, Henderson, Hopkins, Houston, Lee, Leon, Milam, Nacogdoches, Shelby, Titus, and Wood, lignite	967, 330	4, 199	12, 286	------------	983, 815	1, 088, 000	1. 11	953	319	193	1, 465	174	3. 85
Total, excluding wagon mines	1, 119, 048	7, 256	20, 707	------------	1, 147, 011	1, 721, 000	1. 50	1, 426	456	313	2, 195	166	3. 16

UTAH

County	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Value: Total	Value: Average per ton	Miners, loaders, and shot firers	All others	Surface	Total	Average number of days worked	Average tons per man per day
1923													
Carbon	3, 805, 385	37, 388	74, 105	403, 054	4, 319, 932	$12, 511, 000	$2. 90	2, 174	970	859	4, 003	161	6. 68
Emery	246, 797	7, 704	336	------------	254, 837	785, 000	3. 08	132	48	41	221	115	10. 03

Summit	42, 962	7, 510	691		51, 163	123, 000	2. 40	33	27	18	78	157	4. 17
Other counties [e]	83, 749	3, 869	6, 267		93, 885	237, 000	2. 52	40	18	21	79	191	6. 23
Total, excluding wagon mines	4, 178, 893	56, 471	81, 399	403, 054	4, 719, 817	13, 656, 000	2. 89	2, 379	1, 063	939	4, 381	160	6. 75
Wagon mines served by rail	400				400	1, 000	2. 50						
Grand total	4, 179, 293	56, 471	81, 399	403, 054	4, 720, 217	13, 657, 000	2. 89						
1924													
Carbon	3, 710, 507	28, 515	52, 779	268, 930	4, 060, 731	10, 867, 000	2. 68	2, 162	918	863	3, 943	186	5. 53
Emery	274, 727	8, 351	399		283, 477	814, 000	2. 87	129	51	49	229	135	9. 18
Uintah		4, 184			4, 184	17, 000	4. 06	7	3	2	12	120	2. 92
Other counties [f]	122, 027	10, 350	7, 388		139, 765	359, 000	2. 57	71	51	24	146	146	6. 54
Total, excluding wagon mines	4, 107, 261	51, 400	60, 566	268, 930	4, 488, 157	12, 057, 000	2. 69	2, 369	1, 023	938	4, 330	182	5. 70

VIRGINIA [g]

1923													
Dickenson	903, 007	8, 492	13, 530		925, 029	$2, 485, 000	$2. 69	436	300	216	952	225	4. 31
Lee	1, 007, 318	9, 735	7, 615		1, 024, 668	2, 726, 000	2. 66	824	487	263	1, 574	188	3. 46
Montgomery	57, 447	3, 254	10, 656		71, 357	353, 000	4. 95	81	42	42	165	138	3. 14
Russell	2, 024, 361	33, 243	8, 453		2, 066, 057	5, 392, 000	2. 61	1, 042	706	432	2, 180	205	4. 63
Tazewell	1, 462, 678	16, 061	14, 136		1, 492, 875	4, 728, 000	3. 16	937	756	405	2, 098	168	4. 24
Wise	4, 701, 364	125, 872	25, 116	1, 160, 780	6, 013, 132	16, 029, 000	2. 67	3, 384	2, 498	1, 034	6, 916	231	3. 76
Other counties [h]	126, 983	15, 474	16, 535		158, 992	724, 000	4. 55	106	52	77	235	275	2. 46
Total, excluding wagon mines	10, 283, 158	212, 131	96, 041	1, 160, 780	11, 752, 110	32, 437, 000	2. 76	6, 810	4, 841	2, 469	14, 120	212	3. 92
Wagon mines served by rail	9, 533				9, 533	31, 000	3. 22						
Grand total	10, 292, 691	212, 131	96, 041	1, 160, 780	11, 761, 643	32, 468, 000	2. 76						
1924													
Dickenson	783, 552	6, 111	4, 574		794, 237	1, 583, 000	1. 99	373	271	184	828	224	4. 27
Lee	1, 125, 880	11, 493	2, 729		1, 140, 102	2, 150, 000	1. 89	876	379	314	1, 569	201	3. 61
Montgomery	39, 500	532	721		40, 753	132, 000	3. 24	78	28	65	171	166	1. 43
Russell	1, 569, 607	27, 718	4, 748		1, 602, 073	3, 224, 000	2. 01	829	626	377	1, 832	216	4. 04
Tazewell	1, 775, 075	19, 019	7, 336		1, 801, 430	3, 629, 000	2. 01	782	845	408	2, 035	212	4. 17
Wise	4, 320, 635	101, 721	25, 243	716, 821	5, 164, 420	10, 543, 000	2. 04	3, 107	2, 050	854	6, 011	243	3. 54
Other counties [i]	141, 913	1, 936	6, 600		150, 449	562, 000	3. 74	86	56	91	233	221	2. 93
Total, excluding wagon mines	9, 756, 162	168, 530	51, 951	716, 821	10, 693, 464	21, 823, 000	2. 04	6, 131	4, 255	2, 293	12, 679	226	3. 73

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[a] The number of active mines of commercial size in Texas was 44 in both 1923 and 1924.

[b] The number of active mines of commercial size in Utah was 37 in 1923 and 39 in 1924.

[e] Grand, Iron, San Juan, and Uintah.

[f] Grand, Iron, San Juan, Sevier, and Summit.

[g] The number of active mines of commercial size in Virginia was 168 in 1923 and 115 in 1924.

[h] Chesterfield, Pulaski, and Scott.

[i] Pulaski and Scott.

TABLE 71.—*Production, value, men employed, days worked, and output per man at coal mines in specified States and counties, 1923–24*—Continued

WASHINGTON [v]

County	Net tons					Value		Number of employees				Average number of days worked	Average tons per man per day
								Underground					
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	All others	Surface	Total		
1923													
King	598, 077	28, 118	13, 236		639, 431	$2, 225, 000	$3. 48	516	385	239	1, 140	218	2. 58
Kittitas	1, 294, 588	19, 485	43, 934		1, 358, 007	5, 212, 000	3. 84	1, 177	351	284	1, 812	190	3. 94
Lewis	92, 836	15, 978	4, 974		113, 788	318, 000	2. 79	101	63	50	214	156	3. 41
Pierce	282, 309	3, 676	14, 681	59, 554	360, 220	1, 653, 000	4. 59	295	281	182	758	261	1. 82
Thurston	257, 454	3, 796	5, 800		267, 050	801, 000	3. 00	109	35	43	187	241	5. 92
Other counties [w]	172, 570	9, 828	5, 348		187, 746	684, 500	3. 65	115	32	48	195	250	3. 85
Total, excluding wagon mines	2, 697, 834	80, 881	87, 973	59, 554	2, 926, 242	10, 893, 500	3. 72	2, 313	1, 147	846	4, 306	213	3. 18
Wagon mines served by rail	150				150	500	3. 33						
Grand total	2, 697, 984	80, 881	87, 973	59, 554	2, 926, 392	10, 894, 000	3. 72						
1924													
King	571, 953	25, 804	13, 536	600	611, 893	2, 062, 000	3. 37	424	280	155	859	236	3. 02
Kittitas	1, 005, 919	19, 643	31, 038		1, 056, 600	3, 893, 000	3. 68	1, 098	300	240	1, 638	163	3. 95
Lewis	81, 850	20, 597	5, 188		107, 635	298, 000	2. 77	79	46	39	164	166	3. 95
Pierce	321, 749	3, 857	13, 229	48, 739	387, 574	1, 838, 000	4. 74	326	287	170	783	234	2. 12
Other counties [x]	460, 588	22, 465	6, 912		489, 965	1, 598, 000	3. 26	265	69	80	414	237	4. 99
Total, excluding wagon mines	2, 442, 059	92, 366	69, 903	49, 339	2, 653, 667	9, 689, 000	3. 65	2, 192	982	684	3, 858	202	3. 41

WEST VIRGINIA [y]

County	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	All others	Surface	Total	Average number of days worked	Average tons per man per day
1923													
Barbour	2, 826, 421	35, 546	15, 768	43, 082	2, 920, 817	$6, 494, 000	$2. 22	1, 866	744	396	3, 006	177	5. 50
Boone	2, 119, 578	28, 211	14, 384		2, 162, 173	5, 321, 000	2. 46	1, 662	823	537	3, 022	130	5. 51
Braxton	282, 917	37, 168	6, 948		327, 033	780, 000	2. 39	308	123	78	509	170	3. 77

Brooke	1,273,872	882,504			2,156,376	5,508,000	2.55	1,239	535	280	2,054	206	5.11
Clay	893,645	26,680	10,347		930,672	2,352,000	2.53	584	247	202	1,033	167	5.38
Fayette	8,645,609	175,876	65,975	628,775	9,516,235	29,198,000	3.07	6,443	3,759	1,722	11,924	157	5.08
Gilmer	115,652	2,672	3,713		122,037	238,000	1.95	64	26	21	111	167	6.58
Grant and Summers	118,990	1,635	6,706		127,331	295,000	2.32	141	45	69	255	205	2.44
Greenbrier	669,275	53,874	1,877		725,026	1,739,000	2.40	327	175	94	596	179	6.80
Hancock	700	2,892			3,592	13,000	3.62	16	5	3	24	70	2.14
Harrison	6,773,953	350,182	10,476		7,134,611	15,647,000	2.19	4,617	1,895	1,110	7,622	158	5.92
Kanawha	5,671,369	82,459	26,351		5,780,179	13,460,000	2.33	4,892	2,458	1,349	8,699	142	4.68
Lewis	52,923	22,307			75,230	170,000	2.26	126	46	30	202	112	3.32
Lincoln	310,678	1,574	1,753		314,005	717,000	2.28	337	179	99	615	103	4.93
Logan	13,397,010	185,720	21,325		13,604,055	34,115,000	2.51	6,807	4,493	2,131	13,431	172	5.88
McDowell	16,385,281	170,176	197,115	173,877	16,926,449	52,182,000	3.08	7,154	5,979	3,862	16,995	172	5.79
Marion	6,856,458	178,129	104,529	116,897	7,256,013	17,226,000	2.37	3,623	1,984	902	6,509	202	5.52
Marshall	1,140,203	555,882	26,827		1,722,912	4,312,000	2.50	967	391	205	1,563	232	4.75
Mason	65,129	22,802	3,945		91,876	241,000	2.63	132	44	32	208	117	3.76
Mercer	3,112,493	51,645	4,060	70,739	3,238,937	10,913,000	3.37	1,595	1,203	767	3,565	176	5.15
Mineral	403,502	6,355	3,781		413,638	1,055,000	2.55	560	147	142	849	124	3.91
Mingo	3,949,279	42,658	33,574		4,025,511	9,795,000	2.43	2,297	1,494	871	4,662	172	5.02
Monongalia	8,308,773	112,001	604	70,672	8,492,050	17,648,000	2.08	4,362	1,754	918	7,034	203	5.95
Nicholas	252,556	17,053	6,310		275,919	760,000	2.75	284	125	78	487	137	4.15
Ohio	1,991,160	324,908	2,863		2,318,931	5,830,0 0	2.51	1,165	332	224	1,721	235	5.72
Preston	1,665,455	210,443	16,378	159,294	2,051,570	4,746,000	2.31	1,773	728	467	2,968	161	4.29
Putnam	340,064	2,651	2,598		345,313	1,178,000	3.41	481	196	84	761	155	2.93
Raleigh	9,013,149	152,048	82,622		9,247,819	28,084,000	3.04	4,998	3,368	1,627	9,993	167	5.53
Randolph	606,475	15,838	14,923	68,830	706,066	2,214,000	3.14	438	131	83	652	148	7.32
Taylor	760,546	6,958	1,137		768,641	1,599,000	2.08	802	294	190	1,286	108	5.52
Tucker	927,413	7,844	50,544	6,326	992,127	3,179,000	3.20	768	278	109	1,155	194	4.43
Upshur	932,047	49,774	9,122		990,943	2,163,000	2.18	698	281	190	1,169	157	5.40
Wayne	195,191	565	2,397		198,153	507,000	2.56	139	66	38	243	151	5.41
Webster	22,302	5,566	12		27,880	94,000	3.37	39	17	11	67	169	2.46
Wyoming	1,812,638	18,750	9,940		1,841,328	5,448,000	2.96	972	842	496	2,310	140	5.70
Total, excluding wagon mines	101,892,706	3,841,346	758,904	1,338,492	107,831,448	285,221,000	2.65	62,676	35,207	19,417	117,300	169	5.44
Wagon mines served by rail	68,493				68,493	260,000	3.80						
Grand total	101,961,199	3,841,346	758,904	1,338,492	107,899,941	285,481,000	2.65						
1924													
Barbour	1,772,449	30,160	10,490	23,488	1,836,587	3,379,000	1.84	1,432	450	267	2,149	146	5.86
Boone	2,310,928	26,383	5,261		2,342,572	3,882,000	1.66	1,530	752	506	2,788	152	5.53
Braxton	179,747	45,067	5,597		230,411	358,000	1.55	193	81	63	337	175	3.90
Brooke	792,469	984,701	300		1,777,470	3,960,000	2.23	1,294	422	223	1,939	160	5.74
Clay	868,733	23,887	10,758		903,378	1,580,000	1.75	478	186	151	815	214	5.18
Fayette	7,632,720	127,388	47,154	231,227	8,038,489	16,377,000	2.04	5,336	3,052	1,554	9,942	172	4.70
Gilmer	114,791	2,868	3,621		121,280	187,000	1.54	47	27	18	92	208	6.32
Greenbrier	982,704	61,263	5,647		1,049,614	1,829,000	1.74	390	261	133	784	230	5.83

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[t] The number of active mines of commercial size in Washington was 56 in 1923 and 58 in 1924.
[u] Cowlitz and Whatcom.
[v] Cowlitz, Thurston, and Whatcom.
[w] The number of active mines of commercial size in West Virginia was 1,666 in 1923 and 1,220 in 1924.

TABLE 71.—*Production, value, men employed, days worked, and output per man at coal mines in specified States and counties, 1923–24*—Continued

WEST VIRGINIA—Continued

County	Net tons					Value		Number of employees				Average number of days worked	Average tons per man per day
								Underground					
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total quantity	Total	Average per ton	Miners, loaders, and shot firers	All others	Surface	Total		
1924—Continued													
Harrison	5,246,245	169,583	6,323		5,422,151	$9,098,000	$1.68	4,026	1,486	896	6,408	134	6.30
Kanawha	4,044,359	105,720	20,137		4,170,216	6,952,000	1.67	3,133	1,615	808	5,556	148	5.07
Lewis	14,454	21,148			35,602	69,000	1.94	52	21	11	84	109	3.90
Lincoln	266,931	3,125	630		270 686	391,000	1.44	283	83	93	459	149	3.96
Logan	17,375,019	222,335	13,109		17,610,463	28,239,000	1.60	6,647	4,039	1,962	12,648	219	6.35
McDowell	17,438,461	164,900	168,377	57,958	17,829,696	35,657,000	2.00	7,140	5,937	3,474	16,551	192	5.62
Marion	4,647,393	193,227	68,469	21,086	4,930,175	9,543,000	1.94	3,498	1,777	750	6,025	140	5.83
Marshall	1,084,580	328,643	84,135		1,497,358	3,118,000	2.08	1,076	337	202	1,615	199	4.65
Mason	33,493	28,512	2,464		64,469	129,000	2.00	75	24	15	114	121	4.69
Mercer	3,443,017	41,813	5,099	69,210	3,559,139	7,182,000	2.02	1,564	1,134	854	3,552	226	4.44
Mineral	262,804	7,890	2,018		272,712	482,000	1.77	401	125	118	644	118	3.60
Mingo	4,850,344	36,371	11,590		4,898,305	8,387,000	1.71	1,940	1,429	859	4,228	226	5.13
Monongalia	6,482,775	115,301	56	14,528	6,612,660	10,470,000	1.58	3,711	1,431	650	5,792	190	6.00
Nicholas	235,394	18,608	9,980		263,982	538,000	2.04	249	116	78	443	155	3.84
Ohio	1,831,431	293,930	5,298		2,130,659	4,161,000	1.95	1,474	431	145	2,050	217	4.78
Preston	1,282,227	66,795	4,364	115,166	1,468,552	2,598,000	1.77	1,230	484	331	2,045	150	4.80
Putnam	83,360	747	1,796		85,903	172,000	2.00	177	102	47	326	78	3.39
Raleigh	9,924,984	100,804	81,986		10,107,774	18,840,000	1.86	4,536	3,032	1,574	9,142	206	5.36
Randolph	497,635	20,445	13,136		531,216	1,124,000	2.12	380	128	80	588	179	5.05
Taylor	285,153	15,240	284		300,677	451,000	1.50	734	304	90	1,128	55	4.88
Tucker	632,256	9,442	34,577	560	676,835	1,494,000	2.21	565	210	78	853	160	4.95
Upshur	541,457	18,043	10,728		570,228	992,000	1.74	387	145	78	610	159	5.88
Webster	15,975	558			16,533	57,000	3.45	35	8	5	48	135	2.55
Wyoming	1,745,163	21,207	12,953		1,779,323	3,046,000	1.71	893	771	475	2,139	162	5.12
Other counties [a]	249,863	1,401	6,518		257,782	487,000	1.89	161	80	68	309	207	4.03
Total, excluding wagon mines	97,169,314	3,307,505	652,855	533,223	101,662,897	185,229,000	1.82	55,067	30,480	16,656	102,203	182	5.48

WYOMING •

1923													
Albany and Uinta	25, 355	9, 752	4, 356	------------	39, 463	$114, 000	$2. 89	35	6	9	50	218	3. 62
Carbon	574, 163	6, 725	17, 931	------------	598, 819	1, 793, 000	2. 99	229	167	87	483	211	5. 86
Converse, Johnson, and Weston	153, 312	8, 938	9, 691	------------	171, 941	546, 000	3. 18	83	47	30	160	245	4. 39
Fremont, Hot Springs, and Park	591, 896	6, 343	38, 447	------------	636, 686	2, 381, 000	3. 74	388	266	151	805	180	4. 38
Lincoln	1, 374, 699	11, 884	68, 846	------------	1, 455, 429	4, 250, 000	2. 92	748	333	269	1, 350	262	4. 11
Sheridan	880, 203	28, 464	7, 931	------------	916, 598	1, 334, 000	1. 45	623	161	140	924	115	8. 59
Sweetwater	3, 649, 501	25, 461	65, 446	------------	3, 740, 408	10, 454, 000	2. 79	2, 097	`1, 040	620	3, 757	183	5. 44
Total, excluding wagon mines	7, 249, 129	97, 567	212, 648	------------	7, 559, 344	20, 872, 000	2. 76	4, 203	2, 020	1, 306	7, 529	192	5. 23
Wagon mines served by rail	15, 687	------------	------------	------------	15, 687	44, 000	2. 80	------------	------------	------------	------------	------------	------------
Grand total	7, 264, 816	97, 567	212, 648	------------	7, 575, 031	20, 916, 000	2. 76	------------	------------	------------	------------	------------	------------
1924													
Albany and Uinta	16, 595	10, 177	3, 334	------------	30, 106	83, 000	2. 76	28	5	13	46	183	3. 58
Campbell, Johnson, and Weston	136, 470	13, 770	13, 191	------------	163, 431	467, 000	2. 86	90	49	36	175	212	4. 41
Carbon	496, 496	9, 296	16, 400	------------	522, 192	1, 431, 000	2. 74	193	136	78	407	194	6. 61
Fremont, Hot Springs, and Park	509, 871	6, 221	35, 638	------------	551, 730	2, 004, 000	3. 63	385	230	131	746	173	4. 27
Lincoln	1, 263, 073	11, 949	67, 869	------------	1, 342, 891	3, 803, 000	2. 83	877	352	271	1, 500	222	4. 04
Sheridan	846, 924	28, 732	4, 306	------------	879, 962	1, 568, 000	1. 78	651	162	142	955	110	8. 41
Sweetwater	3, 177, 878	31, 910	57, 368	------------	3, 267, 156	8, 971, 000	2. 75	2, 061	838	385	3, 284	170	5. 85
Total, excluding wagon mines	6, 447, 307	112, 055	198, 106	------------	6, 757, 468	18, 327, 000	2. 71	4, 285	1, 772	1, 056	7, 113	176	5. 41

• Grant, Hancock, and Wayne.

• The number of active mines of commercial size in Wyoming was 62 in both 1923 and 1924.

TABLE 72.—*Coal produced and consumed in Alaska, 1880–1924*

Year	Produced in Alaska, chiefly subbituminous and lignite[a]		Imported from States, chiefly bituminous coal from Washington[b] (net tons)	Imported from foreign countries, chiefly bituminous coal from British Columbia[b] (net tons)	Total coal consumed (net tons)
	Net tons	Value			
1880–1890	6,076	$37,205	(b)	(b)	(b)
1891	1,083	6,291			
1892	871	5,093			
1893	923	5,372			
1894	488	2,765			
1895	1,687	9,290			
1896	712	4,142			
1897	2,673	31,393			
1898	2,652	27,201			
1899	2,264	22,836	10,000	[c] 50,120	62,384
1900	2,855	35,275	15,048	[c] 56,623	74,526
1901	2,740	29,843	24,000	[c] 77,674	104,414
1902	3,052	22,508	40,000	[c] 68,363	111,415
1903	2,717	21,302	64,626	[c] 60,605	127,948
1904	1,824	8,195	36,689	[c] 76,815	115,328
1905	4,334	15,070	67,713	[c] 72,612	144,659
1906	6,061	19,924	69,493	[c] 47,590	123,144
1907	10,689	55,770	46,246	[c] 93,262	150,197
1908	4,066	22,665	23,893	[c] 86,404	114,363
1909	3,430	16,350	33,112	69,046	105,588
1910	2,250	13,200	32,098	58,420	92,768
1911	1,850	11,690	32,255	61,845	95,950
1912	1,205	7,130	27,767	68,316	97,288
1913	2,312	13,290	69,066	56,430	127,808
1914	1,190	6,540	41,509	46,153	88,852
1915	1,629	6,653	46,329	29,457	77,415
1916	12,676	57,412	44,934	53,672	111,282
1917	54,275	268,438	58,116	56,589	168,980
1918	75,816	413,870	51,520	37,986	165,322
1919	60,894	345,617	57,166	48,708	166,768
1920	61,111	355,668	38,128	45,264	144,503
1921	76,817	496,394	24,278	33,776	134,871
1922	79,275	430,639	28,457	34,251	141,983
1923	119,826	755,469	34,082	43,205	197,113
1924	99,663	559,980	40,161	41,980	181,804
	711,986	4,140,480	1,056,686	1,475,166	3,226,673

[a] Compiled by the Alaska branch of the Geological Survey.

[b] Compiled from Monthly Summary of Foreign Commerce of the United States, 1905–1924, Bureau of Foreign and Domestic Commerce. No figures on imports before 1899 are available.

[c] For fiscal year ended June 30.

TABLE 73.—*Production, value, men employed, and days worked at coal mines in California, Idaho, Nebraska, Nevada, and Oregon, 1913–1924* [a]

[California, Idaho, and Oregon produced in each year of the period 1913 to 1924. Nevada produced in 1914 and 1915 only, and Nebraska in 1924 only]

Year	Net tons				Value		Number of employees	Average number of days worked
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Total	Total	Average per ton		
Excluding Oregon:								
1913	14,864	1,808	8,167	24,839	$84,073	$3.38	35	332
1914	4,200	9,174	600	13,974	39,821	2.85	43	291
1915	2,488	9,715	300	12,503	32,054	2.56	36	285
1916	1,593	4,647	1,000	7,240	15,367	2.12	18	188
1917	2,800	3,383	240	6,423	14,791	2.30	17	173
1918	5,800	600	----------	6,400	17,250	2.70	15	240
1919	2,448	3,591	515	6,554	22,174	3.38	77	59
1920	208	2,540	5	2,753	12,000	4.23	10	181
Including Oregon:								
1921	19,015	13,305	6,525	38,845	181,000	4.66	141	149
1922	17,011	3,662	6,220	26,893	104,000	3.87	60	250
1923	11,256	1,555	7,255	20,066	79,000	3.94	93	206
1924	8,352	7,851	750	16,953	71,000	4.19	83	156

[a] Figures for Oregon for 1918 to 1920 will be found in Table 76.

TABLE 74.—*Production, value, men employed, and days worked at coal mines in Georgia, 1918–1924*

Year	Net tons					Value		Number of employees	Average number of days worked
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Made into coke at mines	Total	Total	Average per ton		
1918	21,725	888	6,250	37,853	66,716	$239,377	$3.59	190	258
1919	15,028	679	4,600	33,030	53,337	198,033	3.71	168	284
1920	15,961	791	3,600	29,804	50,156	251,000	5.00	148	294
1921	18,755	373	1,979	12,708	33,815	171,000	2.14	136	183
1922	41,809	535	2,114	16,178	60,636	246,000	4.06	150	242
1923	48.172	733	2,554	24,161	75,620	327,000	4.32	167	231
1924	58,097	611	1.839	14,400	74,947	271,000	3.62	143	248

TABLE 75.—*Production, value, men employed, and days worked at coal mines in North Carolina, 1918–1924*

Year	Net tons				Value		Number of employees	Average number of days worked
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Total	Total	Average per ton		
1918	466	42	912	1,420	$6,700	$4.74	50	40
1919	3,229	387	3,373	6,989	27,000	3.84	49	100
1920	8,660		2,880	11,540	81,000	7.02	50	288
1921	20.000		3,438	23,438	135,000	5.76	60	300
1922	68,524	1,500	8,546	78,570	388,000	4.94	127	167
1923	29,419	1,700	4,900	36,019	132,000	3.66	150	275
1924	51,094	1,200	4,800	57,094	224,000	3.92	120	287

TABLE 76.—*Production, value, men employed, and days worked at coal mines in Oregon, 1918–1920* [a]

Year	Net tons				Value		Number of employees	Average number of days worked
	Loaded at mines for shipment	Sold to local trade and used by employees	Used at mines for steam and heat	Total	Total	Average per ton		
1918	4,112	3,946	5,270	13,328	$37,454	$2.81	40	292
1919	10,917	3.103	4,719	18,739	63.794	3.40	67	259
1920	12,980	1,609	6,128	20,717	93,000	4.47	85	307

[a] Beginning with 1921 figures have been included with those for California; see Table 73.

TABLE 77.—*Coal produced in specified States and counties, 1920–1924, net tons*

ALABAMA

County	1920	1921	1922	1923	1924
Bibb	968, 011	643, 992	1, 039, 689	1, 227, 071	1, 072, 533
Blount	285, 384	302, 390	320, 960	263, 515	126, 002
Cullman and Marion	121, 886	84, 791	[a] 151, 253	[a] 179, 140	(a)
Etowah	76, 568	75, 107	98, 810	132, 155	131, 215
Jefferson	7, 719, 910	5, 864, 475	8, 184, 867	9, 749, 869	9, 592, 462
St. Clair	662, 209	646, 212	803, 297	803, 281	[b] 814, 216
Shelby	586, 996	460, 496	627, 141	676, 477	713, 587
Tuscaloosa	914, 183	538, 402	1, 176, 764	1, 217, 227	1, 127, 836
Walker	4, 768, 457	3, 919, 884	5, 797, 279	6, 149, 068	5, 530, 762
Winston	36, 495	33, 150	28, 380	21, 836	21, 571
Small mines	154, 000	(*)	96, 300	38, 010	(*)
Total tonnage	16, 294, 099	12, 568, 899	18, 324, 740	20, 457, 649	19, 130, 184
Total value	$59, 410, 000	$38, 713, 000	$42. 856, 000	$51, 624, 000	$44, 756, 000

ARKANSAS

Franklin	278, 450	164, 046	168, 654	254, 041	229, 404
Johnson	257, 517	58, 792	132, 331	179, 791	290, 952
Logan	66, 636	74, 962	59, 861	84, 526	159, 519
Pope, Scott, and Washington	126, 528	[c] 103, 156	32, 599	72, 167	[c] 68, 442
Sebastian	1, 321, 465	826, 821	692, 601	642, 717	703, 186
Small mines	53, 000	(*)	24, 000	63, 650	(*)
Total tonnage	2, 103, 596	1, 227, 777	1, 110, 046	1, 296, 892	1, 451, 503
Total value	$9, 592, 000	$5, 360, 000	$4, 592, 000	$5, 192, 000	$5, 898, 000

COLORADO

Boulder	1, 218, 504	851, 686	728, 943	628, 002	683, 544
Delta	120, 899	89, 935	105, 203	107, 600	87, 325
El Paso	383, 977	288, 531	389, 403	355, 583	363, 941
Fremont	871, 532	590, 821	478, 202	613, 463	698, 300
Garfield	28, 376	16, 795	19, 778	22, 340	26, 420
Gunnison	618, 894	479, 007	437, 522	542, 992	469, 021
Huerfano	2, 395, 261	1, 755, 750	2, 069, 350	1, 965, 417	1, 990, 741
Jackson and Jefferson	228, 821	[d] 181, 027	[d] 246, 639	[d] 214, 047	[d] 129, 841
La Plata	127, 732	99, 653	79, 086	110, 757	92, 136
Las Animas	4, 219, 086	2, 727, 713	3, 370, 064	3, 189, 502	3, 118, 572
Mesa	170, 256	113, 761	151, 937	180, 574	135, 489
Pitkin and Rio Blanco	[e] 6, 472	[e] 10, 992	[e] 12, 226	[e] 15, 836	[e] 88, 479
Routt	964, 342	889, 015	432, 198	803, 455	911, 643
Weld	920, 073	1, 028, 074	1, 473, 911	1, 577, 430	1, 648, 646
Small mines	4, 000	(*)	25, 135	19, 220	(*)
Total tonnage	12, 278, 225	9, 122, 760	10, 019, 597	10, 346, 218	10, 444, 098
Total value	$42, 829, 000	$32, 377, 000	$31, 701, 000	$33, 299, 000	$31, 863, 000

ILLINOIS

Bond, White, etc	[f] 381, 586	[f] 365, 664	[f] 284, 177	[f] 322, 067	[f] 1, 525, 171
Bureau	859, 287	556, 671	407, 824	525, 372	417, 242
Christian	3, 392, 547	2, 950, 910	2, 916, 555	3, 987, 982	3, 676, 246
Clinton	1, 311, 750	802, 228	658, 156	745, 072	(f)
Franklin	12, 837, 993	11, 947, 539	9, 201, 333	13, 695, 989	12, 910, 562
Fulton	2, 712, 598	1, 471, 137	1, 548, 774	2, 150, 824	1, 859, 192
Gallatin	[g] 198, 208	145, 618	56, 131	29, 100	(f)

[a] Cullman, Franklin, and Marion in 1922 and 1923. There was no production in Cullman in 1924, and the figure for Marion is therefore included with St. Clair.

[b] Includes Marion.

[c] No production in Scott in 1921 or in Washington in 1924.

[d] Jackson and Jefferson include Elbert in 1921, Elbert and Pitkin in 1922, Elbert in 1923; Jackson included with Pitkin and Rio Blanco in 1924.

[e] Moffat and Rio Blanco in 1920; Moffat, Montezuma, Ouray, Pitkin, and Rio Blanco in 1921; Archuleta, Moffat, Montezuma, Montrose, Pitkin, and Rio Blanco in 1923; and Archuleta, Jackson, Montrose, Pitkin, and Rio Blanco in 1924.

[f] Bond and White in 1920; Bond, Johnson, and White in 1921 and 1922; Bond, Jefferson, Johnson, and White in 1923; and Bond, Clinton, Gallatin, Jefferson, and White in 1924.

[g] Gallatin includes Johnson in 1920.

* No canvass of wagon mines for 1921 and 1924.

TABLE 77.—*Coal produced in specified States and counties, 1920–1924, net tons*—Continued

ILLINOIS—Continued

County	1920	1921	1922	1923	1924
Greene	[h] 258, 994	6, 959	3, 342	(h)	(h)
Grundy	245, 954	202, 926	156, 097	194, 137	385, 282
Hancock, Schuyler, Scott, and Warren	[i] 7, 798	[i] 189, 107	[i] 196, 245	[h] 131, 176	[h] 252, 268
Henry	24, 809	26, 029	37, 267	58, 380	44, 912
Jackson	1, 037, 844	1, 113, 612	745, 301	1, 354, 084	1, 541, 436
Knox	24, 089	31, 206	25, 912	16, 144	8, 347
La Salle	874, 362	384, 813	483, 357	545, 683	582, 049
Livingston	112, 449	97, 910	30, 892	43, 551	27, 066
Logan, McLean, Putnam, Will, and Woodford	1, 149, 956	751, 506	631, 714	884, 221	593, 995
McDonough	------------	7, 534	3, 552	2, 861	2, 733
Macon	290, 899	226, 734	202, 240	197, 658	(h)
Macoupin	8, 747, 111	6, 230, 953	4, 974, 463	7, 273, 490	5, 840, 619
Madison	4, 814, 927	3, 278, 582	3, 313, 130	3, 810, 845	3, 273, 546
Marion	988, 773	705, 734	657, 474	720, 288	368, 316
Marshall	300, 073	229, 907	235, 258	318, 075	166, 753
Menard	205, 878	123, 341	145, 297	74, 351	52, 140
Mercer	221, 226	185, 342	88, 138	131, 455	116, 182
Montgomery	3, 973, 642	2, 279, 493	2, 052, 685	2, 752, 890	2, 501, 559
Peoria	1, 366, 816	1, 102, 002	1, 024, 887	1, 150, 768	883, 758
Perry	2, 802, 594	2, 403, 471	1, 927, 424	2, 524, 548	1, 945, 376
Randolph	1, 595, 723	1, 810, 158	1, 158, 877	1, 702, 472	1, 152, 633
Rock Island	93, 577	65, 916	(i)	29, 267	19, 770
St. Clair	7, 252, 869	5, 195, 602	4, 318, 288	5, 151, 948	3, 545, 518
Saline	5, 384, 912	4, 532, 475	3, 749, 211	5, 332, 901	4, 900, 157
Sangamon	8, 567, 014	5, 956, 755	5, 461, 883	7, 477, 045	6, 076, 289
Shelby	(h)	76, 320	55, 578	59, 639	(h)
Stark	6, 185	8, 460	10, 620	8, 644	5, 522
Tazewell	925, 627	691, 359	631, 358	770, 487	762, 205
Vermilion	3, 966, 506	3, 040, 165	2, 920, 475	4, 176, 669	3, 386. 483
Washington	769, 697	908, 797	565, 554	470, 231	178, 327
Williamson	10, 926, 620	9, 499, 828	7, 498, 162	10, 431, 740	9, 321, 627
Small mines	94, 000	(*)	90, 105	58, 021	(*)
Total tonnage	88, 724, 893	69, 602, 763	58, 467, 736	79, 310, 075	68, 323, 281
Total value	$273, 509, 000	$190, 986, 000	$168, 925, 000	$198, 388, 000	$155, 260, 000

INDIANA

Clay	1, 370, 402	547, 480	452, 901	645, 393	730, 617
Daviess	343, 572	271, 104	123, 794	171, 931	96, 422
Dubois	[j] 7, 675	[j] 9, 144	[j] 1, 200	[j] 7, 455	[j] 10, 241
Fountain and Warren	2, 571	2, 527	2, 640	2, 514	2, 083
Gibson	823, 057	658, 127	513, 702	542, 200	846, 362
Greene	2, 878, 868	1, 885, 479	1, 946, 445	2, 393, 322	1, 873, 695
Knox	3, 705, 711	2, 736, 111	2, 507, 063	3, 510, 842	2, 364, 015
Owen	121, 928	77, 345	40, 827	93, 986	107, 671
Park	105, 254	28, 249	116, 546	110, 263	84, 534
Perry	15, 997	8, 064	8, 500	(j)	(j)
Pike	1, 422, 013	1, 035, 469	1, 359, 328	1, 818, 324	2, 000, 247
Spencer	32, 713	7, 472	12, 740	6, 877	9, 933
Sullivan	4, 523, 306	3, 418, 435	3, 184, 684	5, 510, 510	4, 919, 197
Vanderburg	370, 993	224, 665	208, 678	308, 584	287, 403
Vermilion	3, 551, 187	2, 185, 886	2, 146, 848	3, 247, 298	2, 208, 293
Vigo	8, 232, 106	6, 364, 245	5, 519, 218	6, 781, 735	5, 079, 692
Warrick	1, 583, 232	859, 707	805, 310	986, 661	859, 808
Small mines	260, 000	(*)	182, 465	91, 204	(*)
Total tonnage	29, 350, 585	20, 319, 509	19, 132, 889	26, 229, 099	21, 480, 213
Total value	$92, 867, 000	$52, 269, 000	$54, 524, 000	$65, 046, 000	$46, 453, 000

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[h] Greene, Moultrie, and Shelby in 1920; Cass, Edgar, Greene, Hancock, Moultrie, Schuyler, and Warren in 1923; and Cass, Edgar, Greene, Hancock, Macon, Schuyler, Scott, Shelby, and Warren in 1924.

[i] Hancock, Schuyler, and Warren in 1920; Cass, Hancock, Moultrie, Schuyler, Scott, and Warren in 1921; and Cass, Hancock, Moultrie, Rock Island, Schuyler, and Scott in 1922.

[j] Dubois includes Crawford in 1920, 1921, and 1922, and Perry in 1923 and 1924.

*No canvass of wagon mines for 1921 and 1924.

TABLE 77.—*Coal produced in specified States and counties, 1920–1924, net tons*—Continued

County	1920	1921	1922	1923	1924
IOWA					
Adams	8,419	[k] 25,821	2,140		7,799
Appanoose	1,511,599	609,397	822,303	931,667	813,800
Boone	322,517	198,738	223,792	264,434	295,094
Dallas	444,670	309,888	312,771	545,861	534,851
Greene	[l] 328,215	[l] 58,092	[l] 554,894	[l] 725,119	[l] 672,365
Guthrie	(l)	(l)	(l)	(l)	5,148
Jasper	(l)	108,410	81,134	103,391	109,638
Jefferson and Keokuk	1,726	[m] 11,590	[m] 14,477	[m] 14,586	[m] 10,235
Lucas	397,682	236,823	(l)	(l)	(l)
Mahaska	64,430	47,751	29,288	37,411	57,450
Marion	805,723	583,188	533,907	740,317	835,641
Monroe	2,503,276	1,519,291	1,036,298	1,557,782	1,085,883
Page and Taylor	22,906	(k)	36,183	28,639	32,298
Polk	1,183,822	750,351	623,872	667,831	893,082
Story and Webster					6,892
Van Buren	8,845	(m)	(m)	(m)	8,645
Wapello	143,793	50,499	25,202	33,067	72,410
Warren	(l)	(l)	(l)	51,880	(l)
Wayne	27,293	21,553	(l)	(l)	27,219
Small mines	39,000	(*)	38,900	8,750	(*)
Total tonnage	7,813,916	4,531,392	4,335,161	5,710,735	5,468,450
Total value	$30,794,000	$17,256,800	$16,119,000	$20,517,000	$18,097,000
KANSAS					
Cherokee	1,090,186	570,601	405,308	725,163	827,218
Crawford	4,508,747	2,713,007	2,201,605	3,410,124	3,222,749
Leavenworth	143,270	133,904	[n] 145,377	[n] 152,043	[n] 170,718
Linn	[o] 13,841	7,459	23,956	40,655	27,048
Osage	82,364	41,670	(n)	(n)	(n)
Small mines	88,000	(*)	178,924	115,161	(*)
Total tonnage	5,926,408	[p] 3,466,641	[p] 2,955,170	4,443,149	4,247,733
Total value	$22,923,000	$13,333,300	$10,816,000	$14,275,000	$12,854,000
KENTUCKY					
Eastern district:					
Bell	2,502,546	1,695,350	1,859,413	2,659,286	2,330,857
Boyd	119,194	42,730	116,456	149,472	68,093
Breathitt	230,953	149,637	294,711	209,140	172,130
Carter	162,264	68,181	162,086	147,860	107,448
Clay	108,970	152,939	139,514	185,063	189,475
Floyd	1,716,504	1,166,038	2,686,862	3,035,371	3,801,168
Harlan	5,057,131	6,895,519	6,231,975	8,581,110	9,572,035
Johnson	797,240	741,150	345,181	659,311	841,824
Knott		(q)	(q)	343,185	344,045
Knox	554,769	507,691	450,361	510,954	443,361
Laurel	137,068	90,228	162,235	108,512	84,631
Lawrence	21,500	(q)	45,705	11,835	(q)
Lee	88,594	32,913	186,714	59,012	38,320
Letcher	3,328,996	2,500,694	3,658,649	4,369,968	4,765,106
McCreary	817,203	611,846	702,638	879,759	846,762
Martin	(q)	65,715	317,718	421,172	422,598
Morgan	76,042	38,009	51,531	32,086	27,564
Perry	3,130,959	4,440,059	4,288,021	5,022,033	5,529,942
Pike	4,925,635	3,317,589	5,671,572	5,893,637	5,895,731
Whitley	693,267	424,139	343,720	497,677	629,707
Other counties [q]	23,669	31,987	216,937	4,110	16,336
	24,492,504	22,972,414	27,931,999	33,780,553	36,127,133

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[k] Adams includes Page and Taylor in 1921.

[l] Greene, Guthrie, Jasper, and Warren in 1920; Greene, Guthrie, and Warren in 1921; Greene, Guthrie, Hardin, Lucas, Warren, and Wayne in 1922; Guthrie, Lucas, and Wayne in 1923; no production in Greene in 1923; and Davis, Greene, Jefferson, Lucas, and Warren in 1924.

[m] Jefferson and Keokuk includes Van Buren in 1921, 1922, and 1923; Jefferson included with Greene, etc., in 1924.

[n] Leavenworth includes Osage in 1922, 1923, and 1924.

[o] Includes Bourbon.

[p] Figures for 1921 and 1922 are incomplete. The State Coal Mine Inspection Department reports 4,028,624 tons produced in 1921 and 3,518,243 tons in 1922.

[q] Martin, Pulaski, and Wayne in 1920; Knott, Lawrence, and Wayne in 1921; Knott, Owsley, and Wayne in 1922; Owsley and Wayne in 1923; and Lawrence, Magoffin, and Wayne in 1924.

* No canvass of wagon mines for 1921 and 1924.

TABLE 77.—*Coal produced in specified States and counties, 1920–1924, net tons*—Continued

KENTUCKY—Continued

County	1920	1921	1922	1923	1924
Western district:					
Christian	[r] 260,914	[r] 125,346	[r] 64,227	[r] 37,613	[r] 22,571
Daviess	94,273	93,021	155,800	119,982	149,889
Hancock	14,130	4,696	([r])	([r])	([r])
Henderson	448,341	340,720	677,080	366,122	427,611
Hopkins	2,755,457	1,997,609	3,476,788	2,716,777	3,551,808
McLean	([r])	91,306	164,319	67,940	50,202
Muhlenberg	3,822,695	3,223,952	4,385,633	3,976,725	1,402,781
Ohio	992,036	863,185	1,195,782	994,687	506,744
Union	1,033,371	821,300	1,416,886	1,264,013	1,081,936
Webster	1,615,041	1,054,721	2,197,608	1,346,420	1,826,529
	11,036,258	8,615,856	13,734,123	10,890,279	9,020,071
Small mines	162,000	(*)	468,053	106,485	(*)
Grand total	35,690,762	31,588,270	42,134,175	44,777,317	45,147,204
Total value	$146,576,000	$85,092,600	$127,037,000	$113,542,000	$84,733,000

MARYLAND

County	1920	1921	1922	1923	1924
Allegany	3,008,728	1,497,077	665,436	1,507,665	1,469,866
Garrett	1,021,511	330,663	527,315	755,612	663,837
Small mines	35,000	(*)	29,956	22,649	(*)
Total tonnage	4,065,239	1,827,740	1,222,707	2,285,926	2,133,703
Total value	$18,815,000	$6,602,000	$4,122,000	$6,911,000	$4,629,000

MICHIGAN

County	1920	1921	1922	1923	1924
Bay	449,687	348,495	[s] 300,154	404,003	258,743
Saginaw	935,048	746,237	629,236	742,172	572,277
Other counties	[t] 103,030	[t] 46,983	([t])	[t] 25,750	------------
Small mines	2,000	(*)	------------	150	(*)
Total tonnage	1,489,765	1,141,715	929,390	1,172,075	831,020
Total value	$7,346,000	$5,555,000	$4,693,000	$5,545,000	$3,602,000

MISSOURI

County	1920	1921	1922	1923	1924
Adair	777,986	527,804	221,703	251,783	154,295
Audrain	18,626	10,538	17,526	15,959	16,920
Barton	965,757	726,347	658,092	704,090	739,854
Bates	115,621	39,690	147,047	119,934	207,847
Boone	18,950	16,128	([u])	[u] 12,200	[u] 19,338
Caldwell, Clay, and Platte	86,617	[v] 91,646	[v] 88,113	[v] 95,292	99,625
Callaway	58,462	32,191	41,255	26,602	([u])
Cooper, etc.[w]	29,300	4,514	13,557	------------	------------
Dade	6,342	([v])	([v])	([v])	------------
Grundy and Harrison	23,080	11,654	[x] 13,259	[x] 12,210	[x] 10,191
Henry	203,200	95,279	115,374	115,094	111,731
Johnson	45,434	15,240	44,201	58,500	([y])
Lafayette	885,569	540,421	416,383	511,277	326,497
Linn	142,290	89,747	53,807	27,964	21,829
Macon	720,227	473,985	352,137	571,350	181,598
Putnam	30,867	13,921	([y])	12,869	8,547
Randolph	422,903	324,836	158,692	233,529	138,224
Ray	578,694	476,117	423,881	518,633	408,202

[r] Christian and McLean in 1920; Christian and Crittenden in 1921; Christian, Crittenden, and Hancock in 1922 and 1923; and Caldwell, Christian, Crittenden, and Hancock in 1924.

[s] Bay includes Calhoun in 1922.

[t] Calhoun and Tuscola in 1920 and 1921; Tuscola only and included with Bay in 1922; and Calhoun and Shiawassee in 1923.

[u] Boone included under "Cooper, etc.," 1922; includes Chariton in 1923; and Chariton and Callaway in 1924.

[v] Caldwell, etc., includes Dade in 1921, 1922, and 1923.

[w] Cooper, Howard, Moniteau, Morgan, and Pettis in 1920; Howard, Moniteau, and Pettis in 1921; and Boone, Chariton, and Moniteau in 1922; no production in Cooper in 1922, 1923, and 1924.

[x] Includes Schuyler in 1922, 1923, and 1924.

[y] Included under "Other counties."

* No canvass of wagon mines for 1921 and 1924.

TABLE 77.—*Coal produced in specified States and counties, 1920–1924, net tons*—Continued

MISSOURI—Continued

County	1920	1921	1922	1923	1924
Vernon	74,771	42,026	30,648	7,824	(z)
Other counties [z]	61,869	19,537	53,657	19,102	36,182
Small mines	103,000	(*)	75,418	88,939	(*)
Total tonnage	5,369,565	3,551,621	2,924,750	3,403,151	2,480,880
Total value	$22,230,000	$13,915,500	$11,153,000	$11,575,000	$8,154,000

MONTANA

County	1920	1921	1922	1923	1924
Blaine	9,240	(a)	13,434	16,077	(a)
Carbon	1,814,486	1,315,722	1,044,222	1,366,970	1,089,214
Cascade	983,885	686,446	669,913	705,529	538,639
Hill	17,936	9,030	13,738	(a)	(a)
Musselshell	1,140,423	662,087	775,777	1,010,438	975,681
Roosevelt	3,000	2,200	(a)	(a)	----------
Sheridan	19,623	9,104	9,086	8,734	11,959
Other counties [a]	415,273	49,369	31,220	36,599	289,872
Small mines	10,000	(*)	14,831	3,331	(*)
Total tonnage	4,413,866	2,733,958	2,572,221	3,147,678	2,905,365
Total value	$13,923,000	$8,921,600	$8,208,500	$9,652,000	$8,596,000

NEW MEXICO

County	1920	1921	1922	1923	1924
Colfax	2,556,919	1,714,851	2,182,518	1,796,038	1,644,611
Lincoln, Santa Fe, and Socorro	274,141	[b] 203,270	[b] 239,365	243,702	[b] 215,549
McKinley	832,202	514,645	665,862	821,415	889,827
Rio Arriba	17,186	20,716	27,986	33,219	31,662
San Juan	2,992	(b)	(b)	4,060	4,414
Small mines	----------	(*)	31,442	16,739	(*)
Total tonnage	3,683,440	2,453,482	3,147,173	2,915,173	2,786,063
Total value	$13,568,000	$9,585,000	$10,977,000	$10,668,000	$9,774,000

NORTH DAKOTA (LIGNITE ONLY)

County	1920	1921	1922	1923	1924
Adams	(c)	(c)	81,079	75,714	44,915
Billings	47,779	33,339	46,144	(c)	(c)
Bowman	(c)	(c)	(c)	(c)	30,486
Burke	99,193	123,722	239,662	239,330	310,679
Burleigh	254,741	237,424	266,178	243,686	134,930
Divide	37,142	37,884	52,677	50,161	37,013
Dunn	(c)	(c)	25,040	14,527	(c)
Grant	----------	----------	19,200	10,174	6,035
Hettinger	13,433	(c)	25,807	16,213	26,051
McLean	32,302	20,669	95,831	120,192	91,369
Mercer	107,587	129,908	135,299	220,157	265,918
Morton	30,942	29,851	51,391	66,034	48,065
Mountrail	----------	----------	----------	1,722	3,286
Stark	64,114	42,704	58,143	69,661	53,500
Ward	86,404	58,603	49,538	74,320	60,178
Williams	73,744	52,992	87,139	81,538	63,552
Other counties [c]	60,244	97,807	34,572	73,525	24,550
Small mines	41,000	(*)	59,864	28,446	(*)
Total tonnage	948,625	864,903	1,327,564	1,385,400	1,200,527
Total value	$2,724,000	$2,329,500	$3,513,000	$3,275,000	$2,473,000

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[z] Chariton, Ralls, and St. Clair in 1920; Chariton, Franklin, Ralls, and St. Clair in 1921; Franklin, Lincoln, Putnam, Ralls, and St. Clair in 1922; Cass, Lincoln, Ralls, and St. Clair in 1923; and Johnson, Ralls, and Vernon in 1924.

[a] Carter, Chouteau, Dawson, Fergus, Golden Valley, Judith Basin, Park, Pondera, Richland, and Toole in 1920; Blaine, Carter, Chouteau, Gallatin, Judith Basin, Park, Pondera, Richland, and Toole in 1921; Chouteau, Gallatin, Pondera, Richland, Roosevelt, and Toole in 1922; Chouteau, Gallatin, Hill, Pondera, Richland, Roosevelt, and Toole in 1923; and Blaine, Chouteau, Custer, Dawson, Fergus, Gallatin, Hill, Judith Basin, Pondera, Richland, Rosebud, Toole, and Wibaux in 1924.

[b] Lincoln, etc., includes San Juan in 1921 and 1922, and Sandoval in 1924

[c] Adams, Bowman, Dunn, Golden Valley, and Oliver in 1920; Adams, Bowman, Dunn, Hettinger, and Oliver in 1921; Bowman and Oliver in 1922; Billings, Bowman, and Oliver in 1923; and Billings, Dunn, Golden Valley, and Oliver in 1924.

*No canvass of wagon mines for 1921 and 1924.

TABLE 77.—*Coal produced in specified States and counties, 1920–1924, net tons*—Continued

OHIO

County	1920	1921	1922	1923	1924
Athens	6, 501, 013	3, 836, 590	3, 295, 689	4, 285, 328	3, 024, 915
Belmont	11, 192, 785	11, 601, 150	6, 759, 817	13, 195, 130	10, 934, 110
Carroll	502, 346	265, 623	334, 640	459, 062	295, 756
Columbiana	857, 192	604, 728	635, 538	941, 742	368, 938
Coshocton	443, 170	207, 166	209, 131	231, 076	189, 528
Gallia	12, 274	(d)	(d)	----------	----------
Guernsey	3, 733, 810	2, 982, 155	2, 076, 107	3, 319, 237	2, 637, 205
Harrison	2, 002, 585	1, 635, 430	2, 143, 265	2, 765, 954	2, 534, 680
Hocking	2, 198, 998	869, 870	868, 639	1, 098, 647	756, 212
Holmes	9, 780	4, 535	4, 688	2, 975	18, 468
Jackson	834, 856	178, 603	270, 778	265, 446	153, 390
Jefferson	6, 243, 200	4, 353, 870	4, 496, 573	6, 507, 010	4, 402, 982
Lawrence	301, 284	57, 569	182, 799	140, 791	111, 175
Mahoning	62, 001	36, 123	53, 796	47, 362	44, 252
Medina	6, 651	3, 184	9, 682	10, 885	(e)
Meigs	1, 509, 837	932, 035	643, 852	1, 217, 329	234, 414
Morgan	[d] 286, 296	[d] 205, 641	[d] 178, 046	[d] 218, 856	[d] 676, 763
Muskingum	653, 056	185, 475	356, 113	480, 625	399, 834
Noble	668, 089	538, 971	337, 858	718, 920	(d)
Perry	3, 651, 343	1, 584, 017	1, 758, 476	2, 538, 951	1, 928, 839
Portage	[e] 140, 874	[e] 98, 061	[e] 70, 512	[e] 118, 454	[e] 92, 387
Stark	449, 852	291, 890	420, 125	443. 562	428, 082
Summit	(e)	(e)	19, 043	(e)	(e)
Tuscarawas	2, 634, 927	1, 360, 779	1, 412, 203	1, 350, 324	1, 138, 097
Vinton	322, 462	109, 311	107, 877	97, 109	91, 310
Wayne	57, 510	(e)	(e)	(e)	11, 670
Small mines	602, 000	(*)	308, 544	91, 668	(*)
Total tonnage	45, 878, 191	31, 942, 776	26, 953, 791	40, 546, 443	30, 473, 007
Total value	$175, 081, 000	$84, 686, 500	$87, 056, 000	$98, 610, 000	$62, 011, 000

OKLAHOMA

Coal	461, 394	187, 451	79, 847	33, 464	29, 249
Craig	12, 700	(f)	(f)	(f)	(f)
Haskell	[g] 96, 070	[g] 83, 910	(f)	130, 695	72, 847
Latimer	800, 442	344, 659	191, 098	137, 144	254, 024
Le Flore	411, 812	296, 814	211, 401	214, 907	163, 139
Muskogee, Rogers, and Wagoner	35, 323	[f] 27, 503	[f] 226, 744	[f] 66, 253	[f] 96, 903
Okmulgee	1, 477, 677	974, 457	829, 554	818, 050	818, 683
Pittsburg	1, 404, 170	1, 283, 551	1, 022, 179	1, 241, 943	717, 794
Tulsa	130, 700	164, 278	222, 242	197, 894	176, 976
Small mines	19, 000	(*)	19, 446	44, 688	(*)
Total tonnage	4, 849, 288	3, 362, 623	2, 802, 511	2, 885, 038	2, 329, 615
Total value	$23, 294, 000	$15, 546, 000	$11, 527, 000	$10, 874, 000	$8, 590. 000

PENNSYLVANIA (BITUMINOUS)

Allegheny	16, 047, 575	11, 931, 527	11, 023, 211	20, 224, 239	14, 497, 825
Armstrong	5, 975, 063	3, 388, 762	3, 265, 848	5, 061, 732	3, 633, 619
Beaver	170, 900	161, 409	226, 959	247, 071	236, 763
Bedford	785, 903	317, 244	340, 434	597, 496	280, 193
Blair	158, 257	92, 144	98, 206	169, 276	71, 687
Bradford	[h] 67, 932	[h] 55, 296	7, 904	10, 330	4, 153
Butler	1, 542, 307	923, 391	1, 837, 961	1, 856, 319	1, 352, 354
Cambria	18, 967, 754	16, 339, 228	12, 957, 315	19, 751, 465	16, 639, 668
Center	1, 735, 045	764, 994	1, 207, 859	1, 356, 503	814, 696
Clarion	1, 567, 095	1, 248, 294	1, 320, 469	1, 900, 549	1, 298, 387
Clearfield	9, 242, 416	5, 853, 922	5, 456, 359	7, 546, 058	5, 311, 004
Clinton	327, 296	83, 641	146, 150	260, 551	299, 926
Elk	1, 258, 834	878, 201	855, 105	1, 147, 125	1, 137, 569
Fayette	30, 742, 236	19, 260, 778	17, 759, 776	32, 165, 961	25, 432, 133
Greene	2, 078, 835	2, 294, 801	2, 348, 527	3, 982, 003	3, 747, 529

[d] Morgan and Washington in 1920; Gallia, Morgan, and Washington in 1921; Gallia, Morgan, Scioto, and Washington in 1922; Morgan, Scioto, and Washington in 1923; and Morgan, Noble, Scioto, and Washington in 1924.

[e] Portage and Summit in 1920; Portage, Summit, and Wayne in 1921; Portage and Wayne in 1922; Portage, Summit, and Wayne in 1923; and Medina, Portage, and Summit in 1924.

[f] Muskogee, etc., includes Craig in 1921, Craig and Haskell in 1922, and Craig in 1923 and 1924.

[g] Haskell includes Atoka in 1920 and 1921.

[h] Bradford includes Fulton and Lycoming in 1920, and Fulton, Lycoming, and McKean in 1921.

[*] No canvass of wagon mines for 1921 and 1924.

TABLE 77.—*Coal produced in specified States and counties, 1920–1924, net tons*—Continued

PENNSYLVANIA (BITUMINOUS)—Continued

County	1920	1921	1922	1923	1924
Huntingdon	839, 613	484, 008	397, 150	757, 678	763, 857
Indiana	11, 414, 048	6, 357, 971	7, 620, 831	10, 475, 299	7, 042, 584
Jefferson	5, 346, 458	2, 707, 894	2, 900, 435	4, 381, 693	2, 944, 076
Lawrence	157, 934	193, 657	208, 907	281, 708	234, 163
Mercer	530, 427	479, 887	457, 453	465, 349	300, 069
Somerset	10, 532, 967	8, 975, 809	7, 628, 253	8, 530, 618	8, 436, 736
Tioga	763, 611	437, 702	374, 154	480, 335	293, 098
Washington	23, 321, 195	14, 716, 984	12, 572, 477	24, 499, 103	17, 937, 840
Westmoreland	24, 510, 146	18, 066, 398	20, 639, 693	25, 408, 870	17, 802, 651
Other counties	(h)	(h)	[i] 50, 682	[i] 83, 625	[i] 121, 193
Small mines	2, 524, 000	(*)	1, 446, 190	238, 957	(*)
Total tonnage	170, 607, 847	116, 013, 942	113, 148, 308	171, 879, 913	130, 633, 773
Total value	$642, 630, 000	$322, 538, 300	$351, 777, 000	$472, 217, 000	$295, 164, 000

SOUTH DAKOTA (LIGNITE ONLY)

County	1920	1921	1922	1923	1924
Dewey and Harding	6, 119	1, 891	1, 330	2, 325	[j] 3, 819
Meade	[k] 650	[k] 791	[k] 937	[k] 586	1, 539
Perkins	6, 008	4, 871	5, 485	7, 468	6, 685
Total tonnage	12, 777	7, 553	7, 752	10, 379	12, 043
Total value	$46, 000	$21, 200	$22, 000	$25, 000	$36, 000

TENNESSEE

County	1920	1921	1922	1923	1924
Anderson	620, 089	333, 416	629, 738	606, 100	671, 794
Campbell	1, 281, 787	1, 044, 037	1, 156, 483	1, 263, 619	1, 053, 296
Claiborne	1, 157, 281	848, 025	650, 712	1, 177, 502	871, 678
Cumberland	74, 149	(l)	10, 637	17, 721	(l)
Fentress	552, 274	394, 894	316, 867	360, 031	264, 054
Grundy	612, 183	386, 764	333, 849	504, 787	231, 040
Hamilton	244, 477	(l)	211, 136	350, 124	120, 856
Marion	357, 419	268, 684	197, 880	191, 534	210, 959
Morgan	443, 930	296, 418	316, 210	422, 406	314, 218
Overton	(l)	155, 952	171, 321	180, 991	123, 182
Roane	151, 603	(l)	103, 867	125, 651	130, 273
Scott	148, 470	113, 836	145, 653	148, 791	181, 342
Other counties [l]	941, 966	618, 300	588, 050	679, 911	383, 863
Small mines	76, 800	(*)	44, 371	11, 100	(*)
Total tonnage	6, 662, 428	4, 460, 326	4, 876, 774	6, 040, 268	4, 556, 555
Total value	$26, 778, 000	$14, 932, 000	$14, 096, 000	$16, 515, 000	$9, 711, 000

TEXAS

County	1920	1921	1922	1923	1924
Bituminous coal counties [la]	545, 227	210, 638	265, 179	175, 332	163, 196
Lignite counties [lb]	1, 069, 788	762, 201	840, 828	1, 011, 997	983, 815
Total tonnage	1, 615, 015	972, 839	1, 106, 007	1, 187, 329	1, 147, 011
Total value	$6, 062, 000	$2, 563, 600	$2, 563, 000	$2, 162, 000	$1, 721, 000

[h] Bradford includes Fulton and Lycoming in 1920, and Fulton, Lycoming, and McKean in 1921.

[i] Cameron, Fulton, Lycoming, and McKean in 1922 and 1923, and Fulton, Lycoming, McKean, and Venango in 1924.

[j] Includes Ziebach in 1924; no production in Dewey.

[k] Includes Ziebach in 1920, 1921, 1922, and 1923, and wagon mines in 1922.

[l] Overton, Rhea, Sequatchie, and White in 1920; Bledsoe, Cumberland, Hamilton, Rhea, Roane, Sequatchie, and White in 1921; Bledsoe, Rhea, Sequatchie, and White in 1922 and 1923; and Bledsoe, Cumberland, Putnam, Rhea, Sequatchie, and White in 1924.

[la] Includes Erath, Maverick, Palo Pinto, Webb, Wise, and Young in 1920 and 1922, and Erath, Maverick, Palo Pinto, Webb, and Wise in 1921, 1923, and 1924.

[lb] Includes Bastrop, Henderson, Hopkins, Houston, Lee, Leon, Medina, Milam, Nacogdoches, Shelby, and Wood in 1920; Bastrop, Henderson, Hopkins, Houston, Leon, Medina, Milam, Shelby, and Wood in 1921; Bastrop, Bexar, Henderson, Hopkins, Houston, Leon, Milam, Nacogdoches, Shelby, Titus, and Wood in 1922; and Anderson, Bastrop, Bexar, Henderson, Hopkins, Houston, Lee, Leon, Milam, Nacogdoches, Shelby, Titus, and Wood in 1923 and 1924.

*No canvass of wagon mines for 1921 and 1924.

TABLE 77.—*Coal produced in specified States and counties, 1920–1924, net tons*—Continued

UTAH

County	1920	1921	1922	1923	1924
Carbon	5,313,202	3,701,641	4,417,645	4,319,932	4,060,731
Emery	482,828	241,278	358,668	254,837	283,477
Summit	65,353	58,171	78,129	51,163	([m])
Uintah	9,228	3,814	3,015	([m])	4,184
Other counties	[m] 132,177	[m] 73,880	[m] 133,901	[m] 93,885	[m] 139,765
Small mines	2,411	(*)	650	400	(*)
Total tonnage	6,005,199	4,078,784	4,992,008	4,720,217	4,488,157
Total value	$19,350,000	$13,662,000	$15,687,500	$13,657,000	$12,057,000

VIRGINIA

Dickenson	614,904	448,387	870,234	925,029	794,237
Lee	946,125	687,928	762,305	1,024,668	1,140,102
Montgomery	44,250	36,730	42,194	71,357	40,753
Pulaski	[n] 129,899	[n] 52,416	[n] 106,281	[n] 158,992	[n] 150,449
Russell	2,122,891	1,543,862	2,070,574	2,066,057	1,602,073
Tazewell	1,323,712	1,253,902	1,563,847	1,492,875	1,801,430
Wise	6,062,325	3,469,153	5,022,866	6,013,132	5,164,420
Small mines	134,500	(*)	52,873	9,533	(*)
Total tonnage	11,378,606	7,492,378	10,491,174	11,761,643	10,693,464
Total value	$45,446,000	$22,947,700	$27,083,000	$32,468,000	$21,823,000

WASHINGTON

King	975,366	341,546	688,034	639,431	611,893
Kittitas	1,837,939	1,391,529	1,053,018	1,358,007	1,056,600
Lewis	151,686	139,437	180,317	113,788	107,635
Pierce	413,579	102,517	303,659	360,220	387,574
Thurston and Whatcom [o]	378,523	453,693	356,137	454,946	489,965
Total tonnage	3,757,093	2,428,722	2,581,165	2,926,392	2,653,667
Total value	$14,560,000	$9,787,000	$10,279,000	$10,894,000	$9,689,000

WEST VIRGINIA

Barbour	1,895,625	1,004,442	1,256,242	2,920,817	1,836,587
Boone	1,613,709	1,180,108	935,414	2,162,173	2,342,572
Braxton	348,017	175,779	293,636	327,033	230,411
Brooke	1,711,712	1,531,457	1,664,586	2,156,376	1,777,470
Clay	519,364	620,527	791,944	930,672	903,378
Fayette	9,015,900	6,136,796	5,780,199	9,516,235	8,038,489
Gilmer	122,793	[p] 42,491	[p] 145,943	122,037	121,280
Grant	262,539	155,634	98,255	[p] 127,331	[q] 257,782
Greenbrier	[q] 124,131	144,921	485,294	725,026	1,049,614
Hancock	9,875	3,356	11,905	3,592	([q])
Harrison	6,053,506	3,767,564	3,385,580	7,134,611	5,422,151
Kanawha	6,426,044	3,955,219	2,635,021	5,780,179	4,170,216
Lewis	73,151	23,440	80,208	75,230	35,602
Lincoln	292,415	245,643	123,730	314,005	270,686
Logan	10,627,263	11,484,117	13,400,349	13,604,055	17,610,463
McDowell	16,819,148	13,703,496	17,121,209	16,926,449	17,829,696
Marion	5,698,876	4,938,874	3,322,572	7,256,013	4,930,175
Marshall	1,251,547	1,092,309	1,371,575	1,722,912	1,497,358
Mason	215,812	69,395	51,758	91,876	64,469
Mercer	2,692,879	3,161,510	3,439,507	3,238,937	3,559,139
Mineral	621,203	102,144	381,706	413,638	272,712
Mingo	1,857,471	1,893,723	3,204,541	4,025,511	4,898,305
Monongalia	3,792,941	3,839,813	4,541,814	8,492,050	6,612,660

[m] Grand and Iron in 1920; Grand, Iron, and Sanpete in 1921; Grand, Iron, San Juan, and Sanpete in 1922; Grand, Iron, San Juan, and Uintah in 1923; and Grand, Iron, San Juan, Sevier, and Summit in 1924.

[n] Pulaski includes Scott in 1920; Chesterfield in 1921; Chesterfield and Scott in 1922 and 1923; and Scott in 1924.

[o] Includes Skagit 1921 and wagon mines in 1920 and 1922; Cowlitz and wagon mines in 1923; and Cowlitz in 1924; no canvass of wagon mines for 1921 and 1924.

[p] Summers included with Greenbrier in 1920, with Gilmer in 1921 and 1922, and with Grant in 1923.

[q] Grant includes Hancock and Wayne in 1924.

[*] No canvass of wagon mines for 1921 and 1924.

TABLE 77.—*Coal produced in specified States and counties, 1920–1924, net tons*—Continued

WEST VIRGINIA—Continued

County	1920	1921	1922	1923	1924
Nicholas	293, 221	133, 200	257, 142	275, 919	263, 982
Ohio	1, 392, 473	1, 444, 604	1, 384, 098	2, 318, 931	2, 130, 659
Preston	2, 001, 440	687, 933	1, 844, 064	2, 051, 570	1, 468, 552
Putnam	339, 092	288, 330	209, 096	345, 313	85, 903
Raleigh	7, 759, 703	7, 200, 902	7, 922, 657	9, 247, 819	10, 107, 774
Randolph	1, 029, 226	550, 001	512, 283	706, 066	531, 216
Taylor	1, 117, 092	516, 849	494, 765	768, 641	300, 677
Tucker	1, 189, 011	901, 297	460, 393	992, 127	676, 835
Upshur	727, 160	508, 974	695, 033	990, 943	570, 228
Wayne	67, 025	35, 259	174, 059	198, 153	(q)
Webster	42, 289	20, 536	31, 999	27, 880	16, 533
Wyoming	1, 447, 054	1, 226, 353	1, 725, 026	1, 841, 328	1, 779, 323
Small mines	520, 000	(*)	254, 589	68, 493	(*)
Total tonnage	89, 970, 707	72, 786, 996	80, 488, 192	107, 899, 941	101, 662, 897
Total value	$390, 046, 000	$206, 661, 500	$236, 162, 000	$285, 481, 000	$185, 229, 000

WYOMING

County	1920	1921	1922	1923	1924
Carbon and Uinta	744, 596	593, 230	[r] 441, 758	[r] 638, 282	[r] 552, 298
Converse, Johnson, and Weston	264, 806	134, 839	[s] 79, 937	171, 941	[s] 163, 431
Fremont, Hot Springs, and Park	888, 497	693, 516	630, 582	636, 686	551, 730
Lincoln	1, 473, 654	1, 302, 855	1, 037, 792	1, 455, 429	1, 342, 891
Sheridan	1, 912, 723	938, 269	803, 057	916, 598	879, 962
Sweetwater	4, 338, 995	3, 537, 957	2, 965, 012	3, 740, 408	3, 267, 156
Small mines	7, 000	(*)	13, 586	15, 687	(*)
Total tonnage	9, 630, 271	7, 200, 666	5, 971, 724	7, 575, 031	6, 757, 468
Total value	$28, 741, 000	$23, 358, 500	$18, 162, 000	$20, 916, 000	$18, 327, 000

[q] Grant includes Hancock and Wayne in 1924.
[r] Includes Albany.
[s] No production in Converse in 1922 and 1924; includes Campbell in 1924.
[*] No canvass of wagon mines for 1921 and 1924.

DETAILED STATISTICS OF PENNSYLVANIA ANTHRACITE

FRESH-MINED, CULM-BANK, AND RIVER COAL

TABLE 78.—*Comparison of anthracite production in 1923 and 1924, classified as fresh-mined, culm-bank, and river coal, and as breaker, washery, and dredge product, in gross tons*

	Classified by source of coal	Classified by type of preparation plant	Difference
1923			
Fresh-mined coal	76, 135, 538		+2, 332, 837
Breaker product		78, 468, 375	
Culm-bank coal	[a] 6, 348, 963		−2, 332, 837
Washery product		4, 016, 126	
River coal	853, 900		
Dredge product		853, 900	
	83, 338, 401	83, 338, 401	
1924			
Fresh-mined coal	75, 656, 355		+1, 013, 000
Breaker product		76, 669, 355	
Culm-bank coal	[a] 2, 112, 813		−1, 013, 000
Washery product		1, 099, 813	
River coal	736, 959		
Dredge product		736, 959	
	78, 506, 127	78, 506, 127	

[a] Includes about 2,300,000 tons of coal put through the breakers in 1923 and 1,013,000 tons in 1924.

PRODUCTION OF ANTHRACITE

TABLE 79.—*Total quantity and total value of anthracite produced, 1890–1924*

Year	Gross tons	Value	Year	Gross tons	Value
1890	41,489,858	[a] $66,383,772	1916	78,195,083	$202,009,561
1895	51,785,122	[a] 82,019,272	1917	88,939,117	283,650,723
1900	51,221,253	[a] 85,757,851	1918	88,237,575	336,480,347
1905	69,339,152	[a] 141,879,000	1919	78,653,751	364,926,950
1910	75,433,246	160,275,302	1920	79,998,437	434,252,198
1911	80,771,488	175,189,392	1921	80,779,867	452,304,903
1912	75,322,855	177,622,626	1922	48,824,127	273,700,125
1913	81,718,680	195,181,127	1923	83,338,401	506,786,768
1914	81,090,631	188,181,399	1924	78,506,127	477,230,852
1915	79,459,876	184,653,498			

[a] Excludes value of coal used at collieries.

TABLE 80.—*Anthracite produced, by regions, 1923–24*

Region	Shipments		Local sales		Colliery fuel		Total	
	Gross tons	Value [a]	Gross tons	Value	Gross tons	Value	Gross tons	Value [a]
1923								
Lehigh:								
Breaker product	9,538,147	$62,782,100	558,796	$2,135,158	1,008,884	$1,752,849	11,105,827	$66,670,107
Washery product	521,744	1,675,656	3,383	3,403	19,363	68,881	544,490	1,747,940
Dredge product	94,725	124,538					94,725	124,538
	10,154,616	64,582,294	562,179	2,138,561	1,028,247	1,821,730	11,745,042	68,542,585
Schuylkill:								
Breaker product	20,377,383	133,635,367	554,910	3,570,662	2,626,295	1,887,047	23,558,588	139,093,076
Washery product	1,552,511	6,185,369	186	1,110	59,537	47,550	1,612,234	6,234,029
Dredge product	284,682	306,184	462,231	369,520	6,370	5,107	753,283	680,811
	22,214,576	140,126,920	1,017,327	3,941,292	2,692,202	1,939,704	25,924,105	146,007,916
Wyoming:								
Breaker product	39,092,074	270,555,028	1,308,115	7,761,854	3,110,108	4,353,633	43,510,297	282,670,515
Washery product	1,680,032	7,215,898	4,852	14,611	174,518	352,536	1,859,402	7,583,045
Dredge product	5,592	5,476			300	240	5,892	5,716
	40,777,698	277,776,402	1,312,967	7,776,465	3,284,926	4,706,409	45,375,591	290,259,276
Sullivan County: Breaker product	280,822	1,912,541	7,841	51,450	5,000	13,000	293,663	1,976,991
Total breaker product	69,288,426	468,885,036	2,429,662	13,519,124	6,750,287	8,006,529	[b] 78,468,375	490,410,689
Total washery product	3,754,287	15,076,923	8,421	19,124	253,418	468,967	4,016,126	15,565,014
Total dredge product	384,999	436,198	462,231	369,520	6,670	5,347	853,900	811,065
Grand total	73,427,712	484,398,157	2,900,314	13,907,768	7,010,375	8,480,843	83,338,401	506,786,768
1924								
Lehigh:								
Breaker product	9,158,262	60,508,183	463,737	2,097,582	947,434	1,595,000	10,569,433	64,200,765
Washery product	58,915	205,270					58,915	205,270
Dredge product	71,366	89,832	331	2,503			71,697	92,335
	9,288,543	60,803,285	464,068	2,100,085	947,434	1,595,000	10,700,045	64,498,370

Schuylkill:								
Breaker product	18,903,109	122,098,013	545,130	3,525,257	2,579,937	1,143,793	22,028,176	126,767,063
Washery product	471,085	1,701,861	8	48	17,836	12,697	488,929	1,714,606
Dredge product	233,006	222,944	402,290	355,752	15,981	6,654	651,277	585,350
	19,607,200	124,022,818	947,428	3,881,057	2,613,754	1,163,144	23,168,382	129,067,019
Wyoming:								
Breaker product	39,373,464	269,666,940	1,297,372	7,964,562	3,230,281	3,136,420	43,901,117	280,767,922
Washery product	530,354	1,995,516	1,081	2,567	20,534	25,427	551,969	2,023,510
Dredge product	13,985	3,496	----------	----------	----------	----------	13,985	3,496
	39,917,803	271,665,952	1,298,453	7,967,129	3,250,815	3,161,847	44,467,071	282,794,928
Sullivan County: Breaker product	157,435	803,903	7,854	56,122	5,340	10,510	170,629	870,535
Total breaker product	67,592,270	453,077,039	2,314,093	13,643,523	6,762,992	5,885,723	[b] 76,669,355	472,606,285
Total washery product	1,060,354	3,902,647	1,089	2,615	38,370	38,124	1,099,813	3,943,386
Total dredge product	318,357	316,272	402,621	358,255	15,981	6,654	736,959	681,181
Grand total	68,970,981	457,295,958	2,717,803	14,004,393	6,817,343	5,930,501	78,506,127	477,230,852

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[a] Value given for shipments is value at which coal left possession of producing company f. o. b. mines and does not include margins of separately incorporated selling companies.

[b] Includes about 2,300,000 tons of culm-bank coal put through the breakers in 1923, and 1,013,000 tons in 1924.

TABLE 81.—*Anthracite produced, 1916–1924*

	Shipped		Sold locally		Colliery fuel		Total	
	Gross tons	Value •	Gross tons	Value	Gross tons	Value	Gross tons	Value •
1916								
Breaker product	64, 367, 754	$189, 472, 889	1, 833, 799	$4, 483, 462	7, 833, 181	$3, 631, 497	74, 034, 734	$197, 587, 848
Washery product	3, 104, 214	3, 840, 147	85, 444	73, 955	827, 381	396, 780	4, 017, 039	4, 310, 882
Dredge product	29, 395	23, 851	59, 406	61, 939	54, 509	25, 041	143, 310	110, 831
	67, 501, 363	193, 336, 887	1, 978, 649	4, 619, 356	8, 715, 071	4, 053, 318	78, 195, 083	202, 009, 561
1917								
Breaker product	72, 077, 334	258, 169, 329	2, 060, 404	5, 979, 059	8, 421, 211	7, 650, 520	82, 558, 949	271, 798, 908
Washery product	5, 365, 517	10, 953, 668	13, 193	20, 720	849, 072	670, 673	6, 227, 782	11, 645, 061
Dredge product	47, 192	70, 804	53, 512	71, 128	51, 682	64, 822	152, 386	206, 754
	77, 490, 043	269, 193, 801	2, 127, 100	6, 070, 907	9, 321, 965	8, 386, 015	88, 939, 117	283, 650, 723
1918								
Breaker product	70, 090, 234	299, 094, 304	2, 238, 447	7, 554, 157	8, 173, 702	9, 842, 547	80, 502, 383	316, 491, 008
Washery product	6, 506, 487	18, 220, 906	22, 759	36, 747	953, 330	1, 365, 121	7, 482, 576	19, 622, 774
Dredge product	124, 436	206, 971	126, 686	155, 352	1, 494	4, 242	252, 616	366, 565
	76, 721, 157	317, 522, 181	2, 387, 892	7, 746, 256	9, 128, 526	11, 211, 910	88, 237, 575	336, 480, 347
1919								
Breaker product	64, 631, 703	335, 134, 951	1, 812, 622	7, 950, 638	7, 717, 629	10, 018, 860	74, 161, 954	353, 104, 449
Washery product	3, 016, 903	9, 625, 998	7, 238	22, 312	848, 823	1, 305, 445	3, 872, 964	10, 953, 755
Dredge product	323, 689	440, 733	288, 016	415, 596	7, 128	12, 417	618, 833	868, 746
	67, 972, 295	345, 201, 682	2, 107, 876	8, 388, 546	8, 573, 580	11, 336, 722	78, 653, 751	364, 926, 950
1920								
Breaker product	63, 598, 683	391, 612, 035	2, 276, 387	11, 045, 824	7, 792, 983	10, 743, 172	73, 668, 053	413, 401, 031
Washery product	4, 615, 514	17, 684, 475	51, 476	123, 969	1, 002, 275	2, 180, 427	5, 669, 265	19, 988, 871
Dredge product	396, 566	544, 105	258, 300	309, 903	6, 253	8, 288	661, 119	862, 296
	68, 610, 763	409, 840, 615	2, 586, 163	11, 479, 696	8, 801, 511	12, 931, 887	79, 998, 437	434, 252, 198

1921								
Breaker product	67, 981, 416	425, 945, 760	2, 209, 660	11, 542, 880	8, 315, 615	8, 853, 308	78, 506, 691	446, 341, 948
Washery product	1, 308, 436	4, 763, 657	14, 513	26, 114	393, 683	522, 530	1, 716, 632	5, 312, 301
Dredge product	264, 711	280, 461	287, 033	365, 212	4, 800	4, 981	556, 544	650, 654
	69, 554, 563	430, 989, 878	2, 511, 206	11, 934, 206	8, 714, 098	9, 380, 819	80, 779, 867	452, 304, 903
1922								
Breaker product	37, 906, 503	245, 136, 576	1, 862, 398	10, 438, 339	5, 304, 701	7, 223, 726	45, 073, 602	262, 798, 641
Washery product	2, 600, 481	9, 311, 615	26, 349	56, 407	316, 456	543, 753	2, 943, 286	9, 911, 775
Dredge product	566, 854	706, 347	234, 646	275, 613	5, 739	7, 749	807, 239	989, 709
	41, 073, 838	255, 154, 538	2, 123, 393	10, 770, 359	5, 626, 896	7, 775, 228	48, 824, 127	273, 700, 125
1923								
Breaker product	69, 288, 426	468, 885, 036	2, 429, 662	13, 519, 124	6, 750, 287	8, 006, 529	[b] 78, 468, 375	490, 410, 689
Washery product	3, 754, 287	15, 076, 923	8, 421	19, 124	253, 418	468, 967	4, 016, 126	15, 565, 014
Dredge product	384, 999	436, 198	462, 231	369, 520	6, 670	5, 347	853, 900	811, 065
	73, 427, 712	484, 398, 157	2, 900, 314	13, 907, 768	7, 010, 375	8, 480, 843	83, 338, 401	506, 786, 768
1924								
Breaker product	67, 592, 270	453, 077, 039	2, 314, 093	13, 643, 523	6, 762, 992	5, 885, 723	[b] 76, 669, 355	472, 606, 285
Washery product	1, 060, 354	3, 902, 647	1, 089	2, 615	38, 370	38, 124	1, 099, 813	3, 943, 386
Dredge product	318, 357	316, 272	402, 621	358, 255	15, 981	6, 654	736, 959	681, 181
	68, 970, 981	457, 295, 958	2, 717, 803	14, 004, 393	6, 817, 343	5, 930, 501	78, 506, 127	477, 230, 852

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[a] Value given for shipments is value at which coal left possession of producing company f. o. b. mines and does not include margins of separately incorporated selling companies.

[b] Includes about 2,300,000 tons of culm-bank coal put through the breakers in 1923 and 1,013,000 tons in 1924.

TABLE 82.—*Anthracite shipped from the Schuylkill, Lehigh, and Wyoming regions in 1807 and from 1820–1924*

Year	Schuylkill region		Lehigh region		Wyoming region		Total (gross tons)
	Gross tons	Percentage	Gross tons	Percentage	Gross tons	Percentage	
1807	---	---	---	---	55	---	55
1820	---	---	365	---	---	---	365
1821	---	---	1, 073	---	---	---	1, 073
1822	1, 480	39. 8	2, 240	60. 2	---	---	3, 720
1823	1, 128	16. 2	5, 823	83. 8	---	---	6, 951
1824	1, 567	14. 1	9, 541	85. 9	---	---	11, 108
1825	6, 500	18. 6	28, 393	81. 4	---	---	34, 893
1826	16, 767	34. 9	31, 280	65. 1	---	---	48, 047
1827	31, 360	49. 4	32, 074	50. 6	---	---	63, 434
1828	47, 284	61. 0	30, 232	39. 0	---	---	77, 516
1829	79, 973	71. 4	25, 110	22. 4	7, 000	6. 2	112, 083
1830	89, 984	51. 5	41, 750	23. 9	43, 000	24. 6	174, 734
1831	81, 854	46. 3	40, 966	23. 2	54, 000	30. 5	176, 820
1832	209, 271	57. 6	70, 000	19. 3	84, 000	23. 1	363, 271
1833	252, 971	51. 9	123, 001	25. 2	111, 777	22. 9	487, 749
1834	226, 692	60. 2	106, 244	28. 2	43, 700	11. 6	376, 636
1835	339, 508	60. 5	131, 250	23. 4	90, 000	16. 1	560, 758
1836	432, 045	63. 1	148, 211	21. 7	103, 861	15. 2	684, 117
1837	530, 152	61. 0	223, 902	25. 7	115, 387	13. 3	869, 441
1838	446, 875	60. 5	213, 615	28. 9	78, 207	10. 6	738, 697
1839	475, 077	58. 1	221, 025	27. 0	122, 300	14. 9	818, 402
1840	490, 596	56. 7	225, 313	26. 1	148, 470	17. 2	864, 379
1841	624, 466	65. 1	143, 037	14. 9	192, 270	20. 0	959, 773
1842	583, 273	52. 6	272, 540	24. 6	252, 599	22. 8	1, 108, 412
1843	710, 200	56. 2	267, 793	21. 2	285, 605	22. 6	1, 263, 598
1844	887, 937	54. 5	377, 002	23. 1	365, 911	22. 4	1, 630, 850
1845	1, 131, 724	56. 2	429, 453	21. 3	451, 836	22. 5	2, 013, 013
1846	1, 308, 500	55. 8	517, 116	22. 1	518, 389	22. 1	2, 344, 005
1847	1, 665, 735	57. 8	633, 507	22. 0	583, 067	20. 2	2, 882, 309
1848	1, 733, 721	56. 1	670, 321	21. 7	685, 196	22. 2	3, 089, 238
1849	1, 728, 500	53. 3	781, 556	24. 1	732, 910	22. 6	3, 242, 966
1850	1, 840, 620	54. 8	690, 456	20. 6	827, 823	24. 6	3, 358, 899
1851	2, 328, 525	52. 3	964, 224	21. 7	1, 156, 167	26. 0	4, 448, 916
1852	2, 636, 835	52. 8	1, 072, 136	21. 5	1, 284, 500	25. 7	4, 993, 471
1853	2, 665, 110	51. 3	1, 054, 309	20. 3	1, 475, 732	28. 4	5, 195, 151
1854	3, 191, 670	53. 2	1, 207, 186	20. 1	1, 603, 478	26. 7	6, 002, 334
1855	3, 552, 943	53. 8	1, 284, 113	19. 4	1, 771, 511	26. 8	6, 608, 567
1856	3, 603, 029	52. 0	1, 351, 970	19. 5	1, 972, 581	28. 5	6, 927, 580
1857	3, 373, 797	50. 8	1, 318, 541	19. 8	1, 952, 603	29. 4	6, 644, 941
1858	3, 273, 245	47. 9	1, 380, 030	20. 2	2, 186, 094	31. 9	6, 839, 369
1859	3, 448, 708	44. 1	1, 628, 311	20. 9	2, 731, 236	35. 0	7, 808, 255
1860	3, 749, 632	44. 0	1, 821, 674	21. 4	2, 941, 817	34. 6	8, 513, 123
1861	3, 160, 747	39. 7	1, 738, 377	21. 9	3, 055, 140	38. 4	7, 954, 264
1862	3, 372, 583	42. 8	1, 351, 054	17. 2	3, 145, 770	40. 0	7, 869, 407
1863	3, 911, 683	40. 9	1, 894, 713	19. 8	3, 759, 610	39. 3	9, 566, 006
1864	4, 161, 970	40. 9	2, 054, 669	20. 2	3, 960, 836	38. 9	10, 177, 475
1865	4, 356, 959	45. 2	2, 040, 913	21. 1	3, 254, 519	33. 7	9, 652, 391
1866	5, 787, 902	45. 6	2, 179, 364	17. 1	4, 736, 616	37. 3	12, 703, 882
1867	5, 161, 671	39. 7	2, 502, 054	19. 3	5, 325, 000	41. 0	12, 988, 725
1868	5, 330, 737	38. 6	2, 502, 582	18. 1	5, 968, 146	43. 3	13, 801, 465
1869	5, 775, 138	41. 7	1, 949, 673	14. 0	6, 141, 369	44. 3	13, 866, 180
1870	4, 968, 157	30. 7	3, 239, 374	20. 0	7, 974, 660	49. 3	16, 182, 191
1871	6, 552, 772	41. 8	2, 235, 707	14. 2	6, 911, 242	44. 0	15, 699, 721
1872	6, 694, 890	34. 1	3, 873, 339	19. 7	9, 101, 549	46. 2	19, 669, 778
1873	7, 212, 601	34. 0	3, 705, 596	17. 4	10, 309, 755	48. 6	21, 227, 952
1874	6, 866, 877	34. 1	3, 773, 836	18. 7	9, 504, 408	47. 2	20, 145, 121
1875	6, 281, 712	31. 9	2, 834, 605	14. 4	10, 596, 155	53. 7	19, 712, 472
1876	6, 221, 934	33. 6	3, 854, 919	20. 9	8, 424, 158	45. 5	18, 501, 011
1877	8, 195, 042	39. 3	4, 332, 760	20. 8	8, 300, 377	39. 9	20, 828, 179
1878	6, 282, 226	35. 7	3, 237, 449	18. 4	8, 085, 587	45. 9	17, 605, 262
1879	8, 960, 829	34. 3	4, 595, 567	17. 6	12, 586, 293	48. 1	26, 142, 689

TABLE 82.—*Anthracite shipped from the Schuylkill, Lehigh, and Wyoming regions in 1807 and from 1820–1924*—Continued

Year	Schuylkill region		Lehigh region		Wyoming region		Total (gross tons)
	Gross tons	Percentage	Gross tons	Percentage	Gross tons	Percentage	
1880	7,554,742	32.3	4,463,221	19.0	11,419,279	48.7	23,437,242
1881	9,253,958	32.4	5,294,676	18.6	13,951,383	49.0	28,500,017
1882	9,459,288	32.5	5,689,437	19.5	13,971,371	48.0	29,120,096
1883	10,074,726	31.7	6,113,809	19.2	15,604,492	49.1	31,793,027
1884	9,478,314	30.9	5,562,226	18.1	15,677,753	51.0	30,718,293
1885	9,488,426	30.0	5,898,634	18.7	16,236,470	51.3	31,623,530
1886	9,381,407	29.2	5,723,129	17.8	17,031,826	53.0	32,136,362
1887	10,609,028	30.6	4,347,061	12.6	19,684,929	56.8	34,641,018
1888	10,654,116	27.9	5,639,236	14.8	21,852,366	57.3	38,145,718
1889	10,486,185	29.3	6,294,073	17.6	19,036,835	53.1	35,817,093
1890	10,867,822	29.7	6,329,658	17.3	19,417,979	53.0	36,615,459
1891	12,741,258	31.5	6,381,838	15.8	21,325,240	52.7	40,448,336
1892	12,626,784	30.1	6,451,076	15.4	22,815,480	54.5	41,893,340
1893	12,357,444	28.7	6,892,352	16.0	23,839,741	55.3	43,089,537
1894	12,035,005	29.1	6,705,434	16.2	22,650,761	54.7	41,391,200
1895	14,269,932	30.7	7,298,124	15.7	24,943,421	53.6	46,511,477
1896	13,097,571	30.4	6,490,441	15.0	23,589,473	54.6	43,177,485
1897	12,181,061	29.3	6,249,540	15.0	23,207,263	55.7	41,637,864
1898	12,078,875	28.8	6,253,109	14.9	23,567,767	56.3	41,899,751
1899	14,199,009	29.8	6,887,909	14.4	26,578,286	55.8	47,665,204
1900	13,502,732	30.0	6,918,627	15.3	24,686,125	54.7	45,107,484
1901	16,019,591	29.9	7,211,974	13.5	30,337,036	56.6	53,568,601
1902	8,471,391	27.2	3,470,736	11.1	19,258,763	61.7	31,200,890
1903	16,474,790	27.7	7,164,783	12.1	35,723,258	60.2	59,362,831
1904	16,379,293	28.5	7,107,220	12.4	34,006,009	59.1	57,492,522
1905	17,703,099	28.8	7,849,205	12.8	35,857,897	58.4	61,410,201
1906	16,011,285	28.8	7,046,617	12.6	32,640,693	58.6	55,698,595
1907	20,141,288	30.0	8,329,653	12.4	38,638,452	57.6	67,109,393
1908	18,006.464	27.9	7,786,255	12.0	38,872,295	60.1	64,665,014
1909	16,864,147	27.2	7,532,271	12.2	37,573,467	60.6	61,969,885
1910	17,845,020	27.5	8,627,539	13.3	38,433,227	59.2	64,905,786
1911	19,118,300	27.4	9,682,147	13.9	41,033,354	58.7	69,833,801
1912	18.213,960	28.2	8,800,125	13.6	37,653,164	58.2	64,667,249
1913	19,417,385	27.4	10,180,021	14.4	41,160,906	58.2	70,758,312
1914 [a]	18,416,586	26.3	10,272,308	14.7	41,258,463	59.0	69.947,357
1915 [a]	18,043,709	26.5	10,190,421	14.9	39,945,344	58.6	68,179,474
1916 [a]	19,677,476	29.3	9,437,545	14.1	37,945,335	56.6	67,060,356
1917 [a]	22,028,055	28.6	11,456,963	14.9	43,577,769	56.5	77,062,787
1918 [a]	22,009,607	28.9	11,552,042	15.1	42,746,038	56.0	76,307,687
1919 [a]	19,248,280	28.5	10,452,093	15.5	37,899,347	56.0	67,599,720
1920 [a]	20,733,428	30.4	9,939,241	14.6	37,517,036	55.0	68,189,705
1921 [a]	20,058,168	28.9	9,357,245	13.5	39,901,464	57.6	69,316,877
1922 [a]	13,007,033	31.8	5,666,833	13.9	22,189,493	54.3	40,863,359
1923 [a]	22,214,576	30.4	10,154,616	13.9	40,777,698	55.7	73,146,890
1924 [a]	19,607,200	28.5	9,288,543	13.5	39,917,803	58.0	68,813,546
	829,163,498	30.7	409,913,240	15.2	1,462,066,823	54.1	2,701,143,561

[a] 1914-1924 inclusive of dredge shipments.

TABLE 83.—*Anthracite produced, by fields, 1913–1924, in gross tons*

[The figures of breaker product include a certain quantity of culm-bank coal, which in 1924 amounted to about 1,013,000 tons]

Year	Northern field •				Eastern middle field			Western middle field			
	Breakers	Washeries	Dredges	Total	Breakers	Washeries	Total	Breakers	Washeries	Dredges	Total
1913	45, 117, 000	1, 915, 000	42, 000	47, 074, 000	7, 479, 000	36, 000	7, 515, 000	15, 584, 000	133, 000	13, 000	15, 730. 000
1914	45, 462, 000	1, 782, 000	3, 000	47, 247, 000	7, 831, 000	35. 000	7, 866, 000	14, 562, 000	215, 000	12, 000	14, 789, 000
1915	43, 600, 000	2, 249, 000	----------	45, 849, 000	7, 664, 000	87, 000	7, 751, 000	14, 564, 000	327, 000	27, 000	14, 918, 000
1916	41, 296, 000	2, 374, 000	4, 000	43, 674, 000	7, 030, 000	77, 000	7, 107, 000	15, 666, 000	532, 000	28, 000	16, 226, 000
1917	46, 201, 000	3, 432, 000	3, 000	49, 636, 000	7, 576, 000	85, 000	7, 661, 000	17, 821, 000	1, 074, 000	44, 000	18, 939, 000
1918	45, 213, 000	3, 529, 000	3, 000	48, 745, 000	7, 631, 000	112, 000	7, 743, 000	17, 289, 000	1, 486, 000	102, 000	18, 877, 000
1919	41, 650, 000	1, 801, 000	18, 000	43, 469, 000	7, 284, 000	288, 000	7, 572, 000	14, 983, 000	871, 000	247, 000	16, 101, 000
1920	40. 398, 000	2, 939, 000	29, 000	43, 366, 000	7, 010, 000.	115, 000	7, 125, 000	16, 123, 000	942, 000	240, 000	17, 305, 000
1921	44, 629, 000	920, 000	35, 000	45, 584, 000	6, 862, 000	78, 000	6, 940, 000	16, 674, 000	319, 000	199, 000	17, 192, 000
1922	24, 971, 000	1, 032, 000	48, 000	26, 051, 000	4, 121, 000	36, 000	4, 157, 000	9, 651, 000	995, 000	194, 000	10, 840, 000
1923	43, 804, 000	1, 859, 000	28, 000	45, 691, 000	7, 039, 000	122, 000	7, 161, 000	16, 548, 000	1, 019, 000	194, 000	17, 761, 000
1924	44, 071, 000	552, 000	14, 000	44, 637, 000	6, 808, 000	6, 000	6, 814, 000	15, 136, 000	423, 000	204, 000	15, 763, 000

Year	Southern field				Total			
	Breakers	Washeries	Dredges	Total	Breakers	Washeries	Dredges	Total
1913	10, 545, 000	776, 000	79, 000	11, 400, 000	78, 725, 000	2, 860, 000	134, 000	81, 719, 000
1914	10, 608, 000	493, 000	88, 000	11, 189, 000	78, 463, 000	2, 525, 000	103, 000	81, 091, 000
1915	10, 361, 000	484, 000	97, 000	10, 942, 000	76, 189, 000	3, 147, 000	124, 000	79, 460, 000
1916	10, 043, 000	1, 034, 000	111, 000	11, 188, 000	74, 035, 000	4, 017, 000	143, 000	78, 195, 000
1917	10, 961, 000	1, 637, 000	105, 000	12, 703, 000	82, 559, 000	6, 228, 000	152, 000	88, 939, 000
1918	10, 369, 000	2, 356, 000	148, 000	12, 873, 000	80, 502, 000	7, 483, 000	253, 000	88, 238, 000
1919	10, 245, 000	913, 000	354, 000	11, 512, 000	74, 162, 000	3, 873, 000	619, 000	78, 654, 000
1920	10, 137. 000	1, 673, 000	392, 000	12, 202, 000	73, 668, 000	5, 669, 000	661, 000	79, 998, 000
1921	10, 341, 000	400, 000	323, 000	11, 064, 000	78, 507, 000	1, 717, 000	556, 000	80, 780, 000
1922	6, 331, 000	880, 000	565, 000	7, 776, 000	45, 074, 000	2, 943, 000	807, 000	48, 824, 000
1923	11, 077, 000	1, 016, 000	632, 000	12, 725, 000	78, 468, 000	4, 016, 000	854, 000	83, 338, 000
1924	10, 654, 000	119, 000	519, 000	11, 292, 000	76, 669, 000	1, 100, 000	737, 000	78, 506, 000

• Includes Sullivan County, which in 1924 contributed 170,000 tons of breaker product.

TABLE 84.—*Anthracite produced, by counties, 1923 and 1924*

County	Shipments		Local sales		Colliery fuel		Total	
	Gross tons	Value [a]	Gross tons	Value	Gross tons	Value	Gross tons	Value [a]
1923								
Berks [b]	23,000	$49,000	19,000	$30,000			42,000	$79,000
Carbon	2,509,000	14,847,000	94,000	308,000	227,000	$541,000	2,830,000	15,696,000
Columbia	940,000	5,146,000	25,000	99,000	114,000	141,000	1,079,000	5,386,000
Cumberland,[b] Lancaster,[b] and York [b]	76,000	71,000	37,000	29,000			113,000	100,000
Dauphin	807,000	5,223,000	386,000	458,000	110,000	192,000	1,303,000	5,873,000
Lackawanna	16,861,000	114,842,000	461,000	2,854,000	1,124,000	1,721,000	18,446,000	119,417,000
Lehigh [b] and Montour [b]	34,000	41,000	1,000	1,000			35,000	42,000
Luzerne	28,076,000	191,922,000	1,255,000	6,492,000	2,665,000	3,726,000	31,996,000	202,140,000
Northumberland	5,249,000	32,720,000	145,000	898,000	803,000	758,000	6,197,000	34,376,000
Schuylkill	17,802,000	112,558,000	451,000	2,563,000	1,908,000	1,295,000	20,161,000	116,416,000
Sullivan	281,000	1,913,000	8,000	52,000	5,000	13,000	294,000	1,978,000
Susquehanna and Wayne	770,000	5,066,000	18,000	124,000	54,000	94,000	842,000	5,284,000
	73,428,000	484,398,000	2,900,000	13,908,000	7,010,000	8,481,000	83,338,000	506,787,000
1924								
Carbon	2,106,000	13,315,000	55,000	295,000	203,000	433,000	2,364,000	14,043,000
Columbia	503,000	2,831,000	25,000	79,000	95,000	133,000	623,000	3,043,000
Dauphin	851,000	5,369,000	329,000	439,000	115,000	18,000	1,295,000	5,826,000
Lackawanna	16,435,000	109,081,000	441,000	2,876,000	1,064,000	1,068,000	17,940,000	113,025,000
Luzerne	27,284,000	189,144,000	1,196,000	6,528,000	2,603,000	2,709,000	31,083,000	198,381,000
Northumberland	5,208,000	32,052,000	177,000	1,053,000	692,000	313,000	6,077,000	33,418,000
Schuylkill	15,598,000	99,576,000	414,000	2,481,000	1,977,000	1,185,000	17,989,000	103,242,000
Sullivan	158,000	804,000	8,000	56,000	5,000	11,000	171,000	871,000
Berks,[b] Cumberland,[b] and York [b]	13,000	10,000	53,000	63,000			66,000	73,000
Susquehanna and Wayne	815,000	5,114,000	20,000	134,000	63,000	61,000	898,000	5,309,000
	68,971,000	457,296,000	2,718,000	14,004,000	6,817,000	5,931,000	78,506,000	477,231,000

[a] Value given for shipments is value at which coal left possession of producing company f. o. b. mines and does not include margins of separately incorporated selling companies

[b] Counties producing dredge coal only.

NUMBER OF OPERATIONS

TABLE 85.—*Number of anthracite breakers, washeries, and dredges active, 1918–1924*

	1918	1919	1920	1921	1922	1923	1924
Lehigh:							
Breakers	34	34	36	33	32	33	33
Washeries	11	12	10	11	11	12	6
Dredges	------	3	3	1	4	3	3
	45	49	49	45	47	48	42
Schuylkill:							
Breakers	78	80	78	79	78	78	78
Washeries	25	24	19	17	24	26	13
Dredges	31	74	56	59	56	56	45
	134	178	153	155	158	160	136
Wyoming:							
Breakers	139	142	135	130	131	144	133
Washeries	40	42	33	27	34	44	22
Dredges	1	3	1	2	2	1	1
	180	187	169	159	167	189	156
Sullivan County: Breakers	3	3	3	3	2	2	3
Total breakers	254	259	252	245	243	257	247
Total washeries	76	78	62	55	69	82	41
Total dredges	32	80	60	62	62	60	49
Grand total	362	417	374	362	374	399	337

SHIPMENTS

TABLE 86.—*Anthracite shipped from breakers, washeries, and dredges, 1890–1924, gross tons* [a]

Year	Breakers [b]	Washeries [b]	Dredges	Total
1890	36,573,000	42,000	----------	36,615,000
1891	40,362,000	86,000	----------	40,448,000
1892	41,803,000	90,000	----------	41,893,000
1893	42,845,000	245,000	----------	43,090,000
1894	40,757,000	634,000	----------	41,391,000
1895	45,430,000	1,081,000	----------	46,511,000
1896	42,282,000	895,000	----------	43,177,000
1897	40,802,000	994,000	----------	41,796,000
1898	40,944,000	1,099,000	----------	42,043,000
1899	46,455,000	1,368,000	----------	47,823,000
1900	43,218,000	2,059,000	----------	45,277,000
1901	51,128,000	2,567,000	----------	53,695,000
1902	29,527,000	1,959,000	----------	31,486,000
1903	56,046,000	3,563,000	----------	59,609,000
1904	54,927,000	2,800,000	----------	57,727,000
1905	59,010,000	2,644,000	----------	61,654,000
1906	52,139,000	3,847,000	----------	55,986,000
1907	63,158,000	4,301,000	----------	67,459,000
1908	61,473,000	3,646,000	----------	65,119,000
1909	58,994,000	3,685,000	9,000	62,688,000
1910	62,417,000	3,296,000	22,000	65,735,000
1911	67,253,000	3,172,000	17,000	70,442,000
1912	62,046,000	3,155,000	28,000	65,229,000
1913	69,206,000	2,090,000	47,000	71,343,000
1914	68,727,000	1,720,000	17,000	70,464,000
1915	66,174,000	2,475,000	17,000	68,666,000
1916	64,368,000	3,104,000	29,000	67,501,000
1917	72,077,000	5,366,000	47,000	77,490,000
1918	70,090,000	6,506,000	125,000	76,721,000
1919	64,632,000	3,017,000	323,000	67,972,000
1920	63,599,000	4,616,000	396,000	68,611,000
1921	67,981,000	1,308,000	265,000	69,554,000
1922	37,907,000	2,600,000	567,000	41,074,000
1923	69,289,000	3,754,000	385,000	73,428,000
1924	67,592,000	1,060,000	319,000	68,971,000

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[a] Includes shipments from Sullivan County, except for 1891 to 1896, for which data are not available.

[b] In recent years, at least, a considerable tonnage of culm-bank coal has been handled in the breakers, so that the figures of shipments from washeries are less than the sales of culm-bank coal.

TABLE 87.—*Anthracite shipped from breakers and washeries, by sizes, 1890–1924* [a]

Year	Domestic		Pea and steam		Total (gross tons)
	Gross tons	Percentage of total	Gross tons	Percentage of total	
1890	28, 154, 000	76. 9	8, 461, 000	23. 1	36, 615, 000
1891	30, 604, 000	75. 7	9, 844. 000	24. 3	40, 448, 000
1892	31, 868, 000	76. 0	10, 025, 000	24. 0	41, 893, 000
1893	32, 294, 000	74. 9	10, 796, 000	25. 1	43, 090, 000
1894	30, 482, 000	73. 7	10, 909, 000	26. 3	41, 391. 000
1895	32, 469, 000	69. 9	14, 042, 000	30. 1	46, 511, 000
1896	30, 355, 000	70. 3	12, 822, 000	29. 7	43, 177, 000
1897	28, 510, 000	68. 5	13, 128, 000	31. 5	41, 638, 000
1898	28, 199, 000	67. 3	13, 701, 000	32. 7	41, 900, 000
1899	31, 507, 000	66. 1	16, 158, 000	33. 9	47, 665, 000
1900	29, 162, 000	64. 7	15, 945, 000	35. 3	45, 107, 090
1901	34, 413, 000	64. 2	19, 156, 000	35. 8	53, 569, 000
1902	19, 026, 000	61. 0	12, 175, 000	39. 0	31, 201, 000
1903	37, 739, 000	63. 6	21, 624, 000	36. 4	59, 363. 000
1904	35, 637, 000	62. 0	21, 856, 000	38. 0	57, 493, 000
1905	37, 425, 000	60. 9	23, 985, 000	39. 1	61, 410, 000
1906	32, 894, 000	59. 1	22, 805, 000	40. 9	55, 699, 000
1907	39, 333, 000	58. 6	27, 776, 000	41. 4	67, 109, 000
1908	38, 319, 000	59. 3	26, 346, 000	40. 7	64, 665, 000
1909	36, 205, 000	58. 3	25, 948, 000	41. 7	62, 153, 000
1910	38, 186, 000	58. 6	27, 008, 000	41. 4	65, 194, 000
1911	41, 476, 000	59. 4	28, 358, 000	40. 6	69, 834, 000
1912	39, 298, 000	60. 8	25, 369, 000	39. 2	64, 667, 000

Year	Domestic		Pea		Steam		Total (gross tons)
	Gross tons	Percentage of total	Gross tons	Percentage of total	Gross tons	Percentage of total	
1913	43, 689, 000	61. 7	8, 143, 000	11. 5	18, 927, 000	26. 8	70, 759, 000
1914	42, 952, 000	61. 4	8, 208, 000	11. 7	18, 770, 000	26. 9	69, 930, 000
1915	40, 993, 000	60. 1	8, 152, 000	12. 0	19, 017, 000	27. 9	68. 162. 000
1916	40, 556, 000	60. 5	7, 468, 000	11. 1	19, 006, 000	28. 4	67, 030, 000
1917	47, 003, 000	61. 0	6, 774, 000	8. 8	23, 239, 000	30. 2	77, 016, 000
1918	45, 795, 000	60. 1	6, 417, 000	8. 4	23, 972, 000	31. 5	76, 184, 000
1919	43, 166, 000	64. 2	6, 185, 000	9. 2	17, 925, 000	26. 6	67, 276, 000
1920	42, 784, 000	63. 1	5, 402, 000	8. 0	19, 607, 000	28. 9	67, 793, 000
1921	45, 906, 000	66. 5	5, 828, 000	8. 4	17, 318, 000	25. 1	69. 052, 000
1922	25, 334, 000	62. 9	3, 256, 000	8. 1	11, 707, 000	29. 0	40, 297, 000
1923	46, 330, 000	63. 7	5, 882, 000	8. 1	20, 550, 000	28. 2	72, 762, 000
1924	44, 761, 000	65. 3	5, 674, 000	8. 3	18, 060, 000	26. 4	68, 495, 000

[a] Exclusive of Sullivan County and dredge coal.

TABLE 88.—*Anthracite shipped, by sizes, 1913–1924* [a]

	Sizes above pea		Pea		Sizes below pea		Total (gross tons)
	Gross tons	Percentage of total	Gross tons	Percentage of total	Gross tons	Percentage of total	
1913: Breaker product	43, 781, 936	63. 3	8, 056, 919	11. 6	17, 366, 691	25. 1	69, 205, 546
Total shipments	43, 935, 224	61. 6	8, 209, 479	11. 5	19, 198, 469	26. 9	71, 343, 172
1914: Breaker product	43, 112, 545	62. 8	8, 142, 829	11. 8	17, 472, 101	25. 4	68, 727, 475
Total shipments	43, 176, 836	61. 3	8, 277, 619	11. 7	19, 009, 591	27. 0	70, 464, 046
1915: Breaker product	41, 125, 513	62. 2	8, 011, 934	12. 1	17, 036, 370	25. 7	66, 173, 817
Total shipments	41, 213, 703	60. 0	8, 210, 668	12. 0	19, 242, 085	28. 0	68, 666, 456
1916: Breaker product	40, 575, 269	63. 1	7, 223, 529	11. 2	16, 568, 956	25. 7	64, 367, 754
Total shipments	40, 747, 215	60. 4	7, 520, 804	11. 1	19, 233, 344	28. 5	67, 501, 363
1917: Breaker product	46, 640, 319	64. 7	6, 298, 870	8. 7	19, 138, 145	26. 6	72, 077. 334
Total shipments	47, 195, 895	60. 9	6, 824, 003	8. 8	23, 470, 145	30. 3	77, 490, 043
1918: Breaker product	45, 323, 253	64. 7	5, 798, 401	8. 3	18, 968, 580	27. 0	70, 090, 234
Total shipments	45, 994, 903	60. 0	6. 471, 381	8. 4	24, 254, 873	31. 6	76, 721. 157
1919: Breaker product	42, 937, 454	66. 4	5, 884, 492	9. 1	15, 809, 757	24. 5	64. 631, 703
Total shipments	43, 349, 551	63. 8	6, 237, 398	9. 2	18, 385, 346	27. 0	67, 972, 295
1920: Breaker product	42, 209, 170	66. 4	5, 008, 050	7. 9	16, 381, 463	25. 7	63, 598, 683
Total shipments	42, 984, 656	62. 6	5, 457, 588	8. 0	20, 168, 519	29. 4	68, 610, 763
1921: Breaker product	45, 796, 115	67. 4	5, 720, 904	8. 4	16. 464, 397	24. 2	67, 981, 416
Total shipments	46, 051, 199	66. 2	5, 865, 379	8. 4	17, 637, 985	25. 4	69, 554, 563
1922: Breaker product	25, 046, 679	66. 1	2, 967, 355	7. 8	9, 892, 469	26. 1	37, 906, 503
Total shipments	25, 409, 723	61. 8	3, 278, 136	8. 0	12, 385, 979	30. 2	41, 073, 838
1923: Breaker product	45, 651, 693	65. 9	5, 544, 915	8. 0	18, 091, 818	26. 1	69, 288, 426
Total shipments	46, 479, 297	63. 3	5, 928, 618	8. 1	21, 019, 797	28. 6	73, 427, 712
1924: Breaker product	44, 566, 747	65. 9	5, 593, 926	8. 3	17, 431, 597	25. 8	67, 592, 270
Total shipments	44, 825, 550	65. 0	5, 689, 000	8. 2	18, 456, 431	26. 8	68, 970, 981

[a] Includes shipments of dredge coal.

TABLE 89.—*Anthracite shipped, by regions and sizes, 1923–24, in gross tons*

[The figures of shipments from breakers include a considerable tonnage of culm-bank coal handled in the breakers]

Size	Lehigh region			Schuylkill region			Wyoming region			Sullivan County breakers	Total	
	Breakers	Washeries	Dredges	Breakers	Washeries	Dredges	Breakers	Washeries	Dredges		Quantity	Percentage of total
1923												
Lump				7,082							7,082	
Broken	166,216	2,773		716,682	3,047		2,565,411	8,367		14,086	3,476,582	4.7
Egg	1,405.101	16,305		2,554,068	7,295		6,912,353	39,918		27,954	10,962,994	14.9
Stove	1,697,987	12,626		3,661,617	17,541		8,161,395	80.074		46,144	13,677,384	18.6
Chestnut	2,425,775	46,856		4,756,618	259,318	206	10,472,092	333,278		61,112	[a] 18,355,255	25.0
Pea	912,632	32,985	291	2,038,969	191,355	236	2,548,984	157,417	1,419	44,330	5,928,618	8.1
Buckwheat No. 1	1,367,965	70,577	433	3,439,731	343,209	1,261	4,133,733	284,328	334		9,641,571	13.2
Buckwheat No. 2 (rice)	700,958	80,620		1,296,794	309,528	5,600	2,560,927	417,002			5,371,429	7.3
Buckwheat No. 3 (barley)	731,739	219,449	59,876	1,735,007	411,960	156,428	1,507,814	295,312			5,117,585	7.0
Boiler	14,426		34,125	2,710	14	12,043	85,529	17,554	3,839		170,240	.2
Other [b]	115,348	39,553		168,105	9,244	108,908	143,836	46,782		87,196	718,972	1.0
	9,538,147	521,744	94,725	20,377,383	1,552,511	284,682	39,092,074	1,680,032	5,592	280,822	73,427,712	100.0
1924												
Lump				13,209							13,209	
Broken	90,451	658		318,787	3,767		1,412,128	4,932		91	1,830,814	2.6
Egg	1,203,604	2,019		2,199,888	15,660		6,391,223	18,726		12,079	9,843,199	14.3
Stove	1,798,113	2,589		3,891,146	19,032		9.270,761	33,993		22,872	15,038,506	21.8
Chestnut	2,392.208	4,003		4,587,386	70,714		10,933,462	82,710		29,339	[c] 18,099,822	26.3
Pea	866,782	6,065		1,912,981	48,601	243	2,799,096	40,165		15,067	5,689,000	8.2
Buckwheat No. 1	1,251,516	7,766	453	2,909,763	84,549	2,609	4,155,074	79,795			8,491,525	12.3
Buckwheat No. 2 (rice)	650,698	8,881	985	1,075,329	89,426		2,627,539	131,670			4,584,528	6.7
Buckwheat No. 3 (barley)	793,073	26,934	46,615	1,861,944	137,533	158,012	1,496.305	120,442			4,640,858	6.7
Boiler	1,687		23,313	382	157	12,014	69,005	680			107,238	.2
Other [b]	110,130			132,294	1,646	60,128	218,871	17,241	13.985	77,987	632,282	.9
	9,158,262	58,915	71,366	18,903,109	471,085	233,006	39,373,464	530,354	13.985	157,435	68,970,981	100.0

[a] Includes 2,328,843 tons of "range" coal.
[b] Includes buckwheat No. 4, silt, culm, screenings, and mine-run coal.
[c] Includes 887,392 tons of "range" coal.

VALUE

TABLE 90.—*Value of anthracite shipped, by regions and sizes, 1923–24* [a]

Size	Lehigh region						Schuylkill region					
	Breakers		Washeries		Dredges		Breakers		Washeries		Dredges	
	Total	Average per ton	Total	Average per ton	Total	Average per ton	Total	Average per ton	Total	Average per ton	Total	Average per ton
1923												
Lump							$59,123	$8.35				
Broken	$1,332,154	$8.01	$21,680	$7.82			6,299,891	8.79	$28,792	$9.45		
Egg	12,221,643	8.69	136,044	8.34			22,609,583	8.85	65,185	8.94		
Stove	14,687,845	8.65	105,556	8.36			32,493,826	8.87	152,146	8.67		
Chestnut	20,851,822	8.60	388,127	8.28			42,136,250	8.86	2,395,854	9.24	$1,825	$8.85
Pea	5,789,990	6.34	204,318	6.19	$1,526	$5.24	12,951,142	6.35	1,189,452	6.21	1,636	6.93
Buckwheat No. 1	4,929,884	3.60	256,740	3.64	974	2.25	11,784,734	3.43	1,156,898	3.37	4,551	3.61
Buckwheat No. 2 (rice)	1,746,908	2.49	203,760	2.53			2,823,608	2.18	651,486	2.10	12,208	2.18
Buckwheat No. 3 (barley)	1,134,835	1.55	327,431	1.49	81,088	1.35	2,350,249	1.35	540,244	1.31	158,152	1.01
Boiler	5,511	.38			40,950	1.20	948	.35	5	.38	11,026	.92
Other	81,508	.71	32,000	.81			126,013	.75	5,307	.57	116,786	1.07
	62,782,100	6.58	1,675,656	3.21	124,538	1.31	133,635,367	6.56	6,185,369	3.98	306,184	1.08
1924												
Lump							68,450	5.18				
Broken	752,367	8.32	5,329	8.10			2,775,392	8.71	33,715	8.95		
Egg	10,570,899	8.78	18,096	8.96			19,248,304	8.75	129,997	8.30		
Stove	16,367,548	9.10	23,646	9.13			35,637,104	9.16	163,780	8.61		
Chestnut	21,397,606	8.95	36,307	9.07			41,275,900	9.00	578,305	8.18		
Pea	5,117,764	5.90	37,053	6.11			10,869,673	5.68	255,214	5.25	931	3.83
Buckwheat No. 1	3,703,720	2.96	24,578	3.16	907	2.00	7,825,702	2.69	214,240	2.53	4,024	1.54
Buckwheat No. 2 (rice)	1,353,806	2.08	20,353	2.29	831	.84	2,049,388	1.91	160,620	1.80		
Buckwheat No. 3 (barley)	1,176,545	1.48	39,908	1.48	53,127	1.14	2,289,486	1.23	164,815	1.20	151,264	.96
Boiler	7,884	4.67			34,967	1.50	500	1.31	733	4.67	10,586	.88
Other	60,044	.55					58,114	.43	442	.27	56,139	.93
	60,508,183	6.61	205,270	3.48	89,832	1.26	122,098,013	6.46	1,701,861	3.61	222,944	.96

Size	Wyoming region						Sullivan County		All regions	
	Breakers		Washeries		Dredges		Breakers			
	Total	Average per ton	Total	Average per ton	Total	Average per ton	Total	Average per ton	Total	Average per ton
1923										
Lump									$59, 123	$8. 35
Broken	$19, 415, 267	$7. 57	$59, 892	$7. 16			$122, 366	$8. 69	27, 280, 042	7. 85
Egg	57, 435, 625	8. 31	305, 408	7. 65			253, 300	9. 06	93, 026, 788	8. 49
Stove	68, 551, 727	8. 40	678, 368	8. 47			429, 565	9. 31	117, 099, 033	8. 56
Chestnut	87, 469, 766	8. 35	2, 856, 871	8. 57			582, 140	9. 53	[b] 156, 682, 655	8. 54
Pea	15, 192, 848	5. 96	907, 968	5. 77	$4, 257	$3. 00	316, 472	7. 14	36, 559, 609	6. 17
Buckwheat No. 1	14, 390, 950	3. 48	980, 783	3. 45	167	. 50			33, 505, 681	3. 48
Buckwheat No. 2 (rice)	5, 585, 362	2. 18	921, 924	2. 21					11, 945, 256	2. 22
Buckwheat No. 3 (barley)	2, 111, 229	1. 40	446, 836	1. 51					7, 150, 064	1. 40
Boiler	142, 051	1. 66	24, 242	1. 38	1, 052	. 27			225, 785	1. 33
Other	260, 203	1. 81	33, 606	. 72			208, 698	2. 39	864, 121	1. 20
	270, 555, 028	6. 92	7, 215, 898	4. 30	5, 476	. 98	1, 912, 541	6. 81	484, 398, 157	6. 60
1924										
Lump									68, 450	5. 18
Broken	10, 911, 739	7. 73	35, 459	7. 19			772	8. 48	14, 514, 773	7. 93
Egg	52, 991, 348	8. 29	148, 892	7. 95			99, 694	8. 25	83, 207, 230	8. 45
Stove	78, 779, 959	8. 50	296, 355	8. 72			197, 080	8. 62	131, 465, 472	8. 74
Chestnut	91, 131, 332	8. 34	696, 769	8. 42			259, 259	8. 84	[c] 155, 375, 478	8. 57
Pea	15, 257, 100	5. 45	202, 449	5. 04			88, 705	5. 89	31, 828, 889	5. 59
Buckwheat No. 1	12, 942, 685	3. 11	204, 461	2. 50					24, 920, 317	2. 93
Buckwheat No. 2 (rice)	5, 016, 332	1. 91	242, 189	1. 84					8, 843, 519	1. 93
Buckwheat No. 3 (barley)	1, 923, 239	1. 29	157, 673	1. 31					5, 956, 657	1. 28
Boiler	86, 438	1. 25	680	1. 00					141, 788	1. 32
Other	626, 768	2. 86	10, 589	. 61	3, 496	2. 50	158, 393	2. 03	973, 985	1. 54
	269, 666, 940	6. 85	1, 995, 516	3. 76	3, 496	2. 50	803, 903	5. 11	457, 295, 958	6. 63

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[a] Value given is value at which coal left possession of producing company f. o. b. mines and does not include margins of separately incorporated selling companies.
[b] Includes $20,179,951, value of "range" coal.
[c] Includes $7,647,592, value of "range" coal.

TABLE 91.—*Average value per gross ton of anthracite shipped, local sales, colliery fuel, and total production, by regions, 1917–1924* [a]

Year and region	Shipments	Local sales	Colliery fuel	Total
1917				
Lehigh	$3.44	$2.20	$1.10	$3.18
Schuylkill	3.48	2.82	.72	3.08
Wyoming	3.48	3.03	.99	3.25
Sullivan County	2.95	3.44	1.03	2.85
	3.47	2.85	.90	3.10
1918				
Lehigh	4.01	2.68	1.36	3.71
Schuylkill	4.13	3.33	.91	3.67
Wyoming	4.18	3.39	1.45	3.92
Sullivan County	3.97	3.99	2.29	3.79
	4.14	3.25	1.23	3.81
1919				
Lehigh	4.86	3.37	1.80	4.51
Schuylkill	4.94	3.43	.85	4.31
Wyoming	5.21	4.55	1.55	4.85
Sullivan County	4.63	4.70	2.29	4.36
	5.08	3.98	1.32	4.64
1920				
Lehigh	5.88	3.29	1.94	5.34
Schuylkill	5.70	4.14	.90	4.99
Wyoming	6.15	5.17	1.80	5.71
Sullivan County	5.60	5.71	2.33	5.27
	5.97	4.44	1.47	5.43
1921				
Lehigh	$6.13	$3.50	$1.59	$5.54
Schuylkill	6.03	4.19	.65	5.22
Wyoming	6.29	5.64	1.27	5.82
Sullivan County	6.21	6.20	2.30	5.53
	6.20	4.75	1.08	5.60
1922				
Lehigh	6.05	3.97	2.34	5.56
Schuylkill	5.78	4.44	.78	4.98
Wyoming	6.52	5.78	1.69	6.02
Sullivan County	5.22	6.18	2.00	4.84
	6.21	5.07	1.38	5.61
1923				
Lehigh	6.36	3.80	1.77	5.84
Schuylkill	6.31	3.87	.72	5.63
Wyoming	6.81	5.92	1.43	6.40
Sullivan County	6.81	6.56	2.60	6.73
	6.60	4.80	1.21	6.08
1924				
Lehigh	6.54	4.53	1.68	6.03
Schuylkill	6.33	4.05	.45	5.57
Wyoming	6.81	6.14	.97	6.36
Sullivan County	5.11	7.15	1.98	5.10
	6.63	5.15	.87	6.08

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[a] Value given is value at which coal left possession of producing company f. o. b. mines and does not include margins of separately incorporated selling companies.

LABOR STATISTICS

Table 92.—*Men employed and days worked in the anthracite field, by regions, 1923 and 1924*

Region	Average number employed					Average number of days worked
	Surface	Underground			Total	
		Miners[a]	All others	Total		
1923						
Lehigh:						
Breakers	6,423	8,189	5,714	13,903	20,326	274
Washeries	299				299	191
Dredges	14				14	153
	6,736	8,189	5,714	13,903	20,639	273
Schuylkill:						
Breakers	15,062	20,860	11,717	32,577	47,639	275
Washeries	1,354				1,354	226
Dredges	357				357	207
	16,773	20,860	11,717	32,577	49,350	273
Wyoming:						
Breakers	18,308	42,956	24,750	67,706	86,014	264
Washeries	961				961	211
Dredges	3				3	98
	19,272	42,956	24,750	67,706	86,978	264
Sullivan County: Breakers	241	357	178	535	776	241
Total breakers	[b]40,034	72,362	42,359	114,721	154,755	269
Total washeries	2,614				2,614	216
Total dredges	374				374	204
Grand total	43,022	72,362	42,359	114,721	157,743	268
1924						
Lehigh:						
Breakers	6,297	7,913	6,077	13,990	20,287	273
Washeries	34				34	73
Dredges	10				10	127
	6,341	7,913	6,077	13,990	20,331	273
Schuylkill:						
Breakers	14,824	22,388	12,406	34,794	49,618	270
Washeries	535				535	141
Dredges	303				303	188
	15,662	22,388	12,406	34,794	50,456	268
Wyoming:						
Breakers	17,974	45,497	24,586	70,083	88,057	280
Washeries	445				445	166
Dredges	2				2	200
	18,421	45,497	24,586	70,083	88,504	280
Sullivan County: Breakers	222	237	259	496	718	200
Total breakers	[b]39,317	76,035	43,328	119,363	158,680	275
Total washeries	1,014				1,014	141
Total dredges	315				315	186
Grand total	40,646	76,035	43,328	119,363	160,009	274

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[a] Operators were requested to give number of "all miners (contract, consideration, and company) and their laborers."

[b] Includes a comparatively small number of washery employees who could not be separated from breaker employees.

Table 93.—*Strikes, suspensions, and lockouts in the anthracite region, 1919–1924*

	Lehigh	Schuylkill	Wyoming	Sullivan County	Total
1919					
Total number employed	19, 164	47, 535	87, 046	826	154, 571
Men on strike	6, 518	4, 212	24, 409	------------	35, 139
Man-days lost account strike	26, 868	15, 787	192, 898	------------	235, 553
Average days lost:					
Per man employed	1	0. 3	2	------------	2
Per man on strike	4	4	8	------------	7
1920					
Total number employed	18, 996	46, 324	78, 978	776	145, 074
Men on strike	15, 666	41, 945	39, 229	------------	96, 840
Man-days lost account strike	230, 734	695, 056	889, 526	------------	1, 815, 316
Average days lost:					
Per man employed	12	15	11	------------	13
Per man on strike	15	17	23	------------	19
1921					
Total number employed	20, 727	49, 761	88, 240	771	159, 499
Men on strike	10, 847	5, 523	35, 747	------------	52, 117
Man-days lost account strike	191, 133	24, 906	607, 240	------------	823, 279
Average days lost:					
Per man employed	9	5	7	------------	5
Per man on strike	18	5	17	------------	16
1922					
Total number employed	20, 180	49, 722	86, 205	742	156, 849
Men on strike	19, 066	41, 893	80, 753	730	142, 442
Man-days lost account strike	2, 615, 717	5, 734, 852	11, 167, 109	105, 348	19, 623, 026
Average days lost:					
Per man employed	130	115	130	142	125
Per man on strike	137	137	138	144	138
1923					
Total number employed	20, 639	49, 350	86, 978	776	157, 743
Men on strike	18, 593	43, 524	72, 772	696	135, 585
Man-days lost account strike	354, 830	805, 640	1, 456, 364	12, 584	2, 629, 418
Average days lost:					
Per man employed	17	16	17	16	17
Per man on strike	19	19	20	18	19
1924					
Total number employed	20, 331	50, 456	88, 504	718	160, 009
Men on strike	10, 145	12, 333	48, 795	------------	71, 273
Man-days lost account strike	151, 243	86, 429	905, 958	------------	1, 143, 630
Average days lost:					
Per man employed	7	2	10	------------	7
Per man on strike	15	7	19	------------	16

METHOD OF MINING

TABLE 94.—*Anthracite mined by machines, 1922–1924*

Region	1922		1923		1924	
	Number of machines	Gross tons	Number of machines	Gross tons	Number of machines	Gross tons
Wyoming	82	448, 922	147	962, 058	193	1, 200, 103
Sullivan County			15	116, 997	19	71, 222
	82	448, 922	162	1, 079, 055	212	1, 271, 325

TABLE 95.—*Anthracite recovered from steam-shovel strip pits, 1922–1924*

Region	1922		1923		1924	
	Number of shovels	Gross tons	Number of shovels	Gross tons	Number of shovels	Gross tons
Lehigh	33	453, 727	38	1, 066, 517	37	963, 885
Schuylkill	24	345, 815	37	761, 135	42	580, 635
Wyoming	12	48, 445	20	192, 971	16	121, 263
	69	847, 987	95	2, 020, 623	95	1, 665, 783

TABLE 96.—*Anthracite produced by dredges, by rivers, 1923–24*

River (including tributaries)	Number of dredges	Gross tons	Value	River (including tributaries)	Number of dredges	Gross tons	Value
1923				1924			
Lehigh	3	94, 725	$124, 538	Lehigh	3	71, 697	$92, 335
Schuylkill	14	86, 834	132, 159	Schuylkill	11	66, 392	74, 733
Susquehanna	43	672, 341	554, 368	Susquehanna	35	598, 870	514, 113
	60	853, 900	811, 065		49	736, 959	681, 181

COAL PRODUCED FROM 1807 TO 1924

Coal was mined in the Richmond Basin before the Revolution, but the Bureau of Mines has been unable to discover any account of the quantities produced. The statistical record of the industry begins with the first shipments of Pennsylvania anthracite in 1807, and the amounts produced before that date must have been very small. The following table, compiled by L. Mann and E. W. Parker from all available sources, gives the production of anthracite and of bituminous coal for the period 1807 to 1820 and for each year thereafter. For the years before 1880, when the annual reports of the United States Geological Survey began, the main reliance of the compilers was the decennial census, supplemented by records from State and trade sources. In the absence of other information estimates were made for the intercensus years to round out the totals.

TABLE 97.—*Coal produced, by States, 1807–1924, net tons*

Year	Pennsylvania	Virginia	Kentucky	Illinois	Ohio	Pennsylvania	Missouri
	Anthracite					*Bituminous*	
1807-1820	12,000	----------	----------	----------	----------	----------	----------
1821	1,322	----------	----------	----------	----------	----------	----------
1822	4,583	54,000	----------	----------	----------	----------	----------
1823	8,563	60,000	----------	----------	----------	----------	----------
1824	13,685	67,040	----------	----------	----------	----------	----------
1825	42,988	75,000	----------	----------	----------	----------	----------
1826	59,194	88,720	----------	----------	----------	----------	----------
1827	78,151	94,000	----------	----------	----------	----------	----------
1828	95,500	100,080	328	----------	----------	----------	----------
1829	138,086	100,000	2,000	----------	----------	----------	----------
1830	215,272	102,800	2,000	----------	----------	----------	----------
1831	217,842	118,000	2,100	----------	----------	----------	----------
1832	447,550	132,000	2,500	----------	----------	----------	----------
1833	600,907	125,000	2,750	6,000	----------	----------	----------
1834	464,015	124,000	5,000	7,500	----------	----------	----------
1835	690,854	120,000	6,000	8,000	----------	----------	----------
1836	842,832	124,000	8,000	10,000	----------	----------	----------
1837	1,071,151	160,000	10,000	12,500	----------	----------	----------
1838	910,075	300,000	11,500	14,000	119,952	----------	----------
1839	1,008,322	396,000	16,000	15,038	125,000	----------	----------
1840	967,108	424,894	23,527	16,967	140,536	464,826	9,972
1841	1,182,441	379,600	35,000	35,000	160,000	475,000	12,000
1842	1,365,563	373,640	50,000	58,000	225,000	500,000	15,000
1843	1,556,753	370,000	60,000	75,000	280,000	650,000	25,000
1844	2,009,207	365,000	75,000	120,000	340,000	675,000	35,000
1845	2,480,032	350,000	100,000	150,000	390,000	700,000	50,000
1846	2,887,815	340,000	115,000	165,000	420,000	760,000	68,000
1847	3,551,005	325,000	120,000	180,000	480,000	399,840	80,000
1848	3,805,942	318,000	125,000	200,000	540,000	500,000	85,000
1849	3,995,334	315,000	140,000	260,000	600,000	750,000	90,000
1850	4,138,164	310,000	150,000	300,000	640,000	1,000,000	100,000
1851	5,481,065	310,000	160,000	320,000	670,000	1,200,000	125,000
1852	6,151,957	325,000	175,000	340,000	700,000	1,400,000	140,000
1853	6,400,426	350,000	180,000	375,000	760,000	1,500,000	160,000
1854	7,394,875	370,000	190,000	385,000	800,000	1,650,000	175,000
1855	8,141,754	380,782	200,000	400,000	890,000	1,780,000	185,000
1856	8,534,779	352,687	215,000	410,000	930,000	1,850,000	200,000
1857	8,186,567	363,605	240,000	450,000	975,000	2,000,000	220,000
1858	8,426,102	377,690	250,000	490,000	1,000,000	2,200,000	240,000
1859	9,619,771	359,055	275,000	530,000	1,060,000	2,400,000	260,000
1860	8,115,842	473,360	285,760	728,400	1,265,600	2,690,786	280,000
1861	9,799,654	445,165	280,000	670,000	1,150,000	3,200,000	300,000
1862	9,695,110	445,124	275,000	780,000	1,200,000	4,060,000	320,000
1863	11,785,320	40,000	250,000	890,000	1,204,581	5,000,000	360,000
1864	12,538,649	40,000	250,000	1,000,000	1,815,622	5,839,000	375,000
1865	11,891,746	40,000	200,000	1,260,000	1,536,218	6,350,000	420,000
1866	15,651,183	40,000	180,000	1,580,000	1,887,424	6,800,000	450,000
1867	16,002,109	50,000	175,000	1,800,000	2,092,334	7,300,000	500,000
1868	17,003,405	59,051	160,000	2,000,000	2,475,844	7,500,000	541,000
1869	17,083,134	65,000	160,000	1,854,000	2,461,986	6,750,000	550,000
1870	15,664,275	61,803	150,582	2,624,163	2,527,285	7,798,518	621,930
1871	19,342,057	70,000	250,000	3,000,000	4,000,000	9,040,565	725,000
1872	24,233,166	69,440	380,800	3,360,000	5,315,294	11,695,040	784,000
1873	26,152,837	67,200	400,000	3,920,000	4,550,028	13,098,829	784,000
1874	24,818,790	70,000	360,000	4,203,000	3,267,585	12,320,000	789,680
1875	22,485,766	60,000	500,000	4,453,178	4,864,259	11,760,000	840,000
1876	22,793,245	55,000	650,000	5,000,000	3,500,000	12,880,000	1,008,000
1877	25,660,316	50,000	850,000	5,350,000	5,250,000	14,000,000	1,008,000
1878	21,689,682	50,000	900,000	5,700,000	5,500,000	15,120,000	1,008,000
1879	30,207,793	45,000	1,000,000	5,000,000	6,000,000	16,240,000	1,008,000
1880	28,649,812	43,079	946,288	6,115,377	6,008,595	18,425,163	844,304
1881	31,920,018	50,000	1,232,000	6,720,000	9,240,000	22,400,000	1,960,000
1882	35,121,256	112,000	1,300,000	9,115,653	9,450,000	24,640,000	2,240,000
1883	38,456,845	252,000	1,650,000	12,123,456	8,229,429	26,880,000	2,520,000
1884	37,156,847	336,000	1,550,000	12,208,075	7,640,062	28,000,000	2,800,000
1885	38,335,974	567,000	1,600,000	11,834,459	7,816,179	26,000,000	3,080,000
1886	39,035,446	684,951	1,550,000	11,175,241	8,435,211	27,094,501	1,800,000
1887	42,088,197	825,263	1,933,185	12,423,066	10,300,708	31,516,856	3,209,916
1888	46,619,564	1,073,000	2,570,000	14,328,181	10,910,951	33,796,727	3,909,967
1889	45,546,970	865,786	2,399,755	12,104,272	9,976,787	36,174,089	2,557,823

TABLE 97.—*Coal produced, by States, 1807–1924, net tons*—Continued

Year	Pennsylvania	Virginia	Kentucky	Illinois	Ohio	Pennsylvania	Missouri
	Anthracite					*Bituminous*	
1890	46, 468, 641	784, 011	2, 701, 496	15, 292, 420	11, 494, 506	42, 302, 173	2, 735, 221
1891	50, 665, 431	736, 399	2, 916, 069	15, 660, 698	12, 868, 683	42, 788, 490	2, 674, 606
1892	52, 472, 504	675, 205	3, 025, 303	17, 862, 276	13, 562, 927	46, 694, 576	2, 733, 949
1893	53, 967, 543	820, 339	3, 007, 179	19, 949, 564	13, 253, 646	44, 070, 724	2, 897, 442
1894	51, 921, 121	1, 229, 083	3, 111, 192	17, 113, 576	11, 909, 856	39, 912, 463	2, 245, 039
1895	57, 999, 337	1, 368, 324	3, 357, 770	17, 735, 864	13, 355, 806	50, 217, 228	2, 372, 393
1896	54, 346, 081	1, 254, 723	3, 333, 478	19, 786, 626	12, 875, 202	49, 557, 453	2, 331, 542
1897	52, 611, 680	1, 528, 302	3, 602, 097	20, 072, 758	12, 196, 942	54, 417, 974	2, 665, 626
1898	53, 382, 644	1, 815, 274	3, 887, 908	18, 599, 299	14, 516, 867	65, 165, 133	2, 688, 321
1899	60, 418, 005	2, 105, 791	4, 607, 255	24, 439, 019	16, 500, 270	74, 150, 175	3, 025, 814
1900	57, 367, 915	2, 393, 754	5, 328, 964	25, 767, 981	18, 988, 150	79, 842, 326	3, 540, 103
1901	67, 471, 667	2, 725, 873	5, 469, 986	27, 331, 552	20, 943, 807	82, 305, 946	3, 802, 088
1902	41, 373, 595	3, 182, 993	6, 766, 984	32, 939, 373	23, 519, 894	98, 574, 367	3, 890, 154
1903	74, 607, 068	3, 451, 307	7, 538, 032	36, 957, 104	24, 838, 103	103, 117, 178	4, 238, 586
1904	73, 156, 709	3, 410, 914	7, 576, 482	36, 475, 060	24, 400, 220	97, 938, 287	4, 168, 308
1905	77, 659, 850	4, 275, 271	8, 432, 523	38, 434, 363	25, 552, 950	118, 413, 637	3, 983, 378
1906	71, 282, 411	4, 254, 879	9, 653, 647	41, 480, 104	27, 731, 640	129, 293, 206	3, 758, 008
1907	85, 604, 312	4, 710, 895	10, 753, 124	51, 317, 146	32, 142, 419	150, 143, 177	3, 997, 936
1908	83, 268, 754	4, 259, 042	10, 246, 553	47, 659, 690	26, 270, 639	117, 179, 527	3, 317, 315
1909	81, 070, 359	4, 752, 217	10, 697, 384	50, 904, 990	27, 939, 641	137, 966, 791	3, 756, 530
1910	84, 485, 236	6, 507, 997	14, 623, 319	45, 900, 246	34, 209, 668	150, 521, 526	2, 982, 433
1911	90, 464, 067	6, 864, 667	14, 049, 703	53, 679, 118	30, 759, 986	144, 561, 257	3, 836, 107
1912	84, 361, 598	7, 846, 638	16, 490, 521	59, 885, 226	34, 528, 727	161, 865, 488	4, 339, 856
1913	91, 524, 922	8, 828, 068	19, 616, 600	61, 618, 744	36, 200, 527	173, 781, 217	4, 318, 125
1914	90, 821, 507	7, 959, 535	20, 382, 763	57, 589, 197	18, 843, 115	147, 983, 294	3, 935, 980
1915	88, 995, 061	8, 122, 596	21, 361, 674	58, 829, 576	22, 434, 691	157, 955, 137	3, 811, 593
1916	87, 578, 493	9, 707, 474	25, 393, 997	66, 195, 336	34, 728, 219	170, 295, 424	4, 742, 146
1917	99, 611, 811	10, 087, 091	27, 807, 971	86, 199, 387	40, 748, 734	172, 448, 142	5, 670, 549
1918	98, 826, 084	10, 289, 808	31, 612, 617	89, 291, 105	45, 812, 943	178, 550, 741	5, 667, 730
1919	88, 092, 201	9, 326, 830	30, 036, 061	60, 862, 608	35, 876, 682	150, 758, 154	3, 979, 798
1920	89, 598, 249	11, 378, 606	35, 690, 762	88, 724, 893	45, 878, 191	170, 607, 847	5, 369, 565
1921	90, 473, 451	7, 492, 378	31, 588, 270	69, 502, 763	31, 942, 776	116, 013, 942	3, 551, 621
1922	54, 683, 022	10, 491, 174	42, 134, 175	58, 467, 736	26, 953, 791	113, 148, 308	2, 924, 750
1923	93, 339, 009	11, 761, 643	44, 777, 317	79, 310, 075	40, 546, 443	171, 879, 913	3, 403, 151
1924	87, 926, 862	10, 693, 464	45, 147, 204	68, 323, 281	30, 473, 007	130, 633, 773	2, 480, 880
	3, 416, 641, 760	203, 598, 380	564, 061, 455	1, 748, 912, 280	1, 056, 917, 138	4, 412, 219, 734	165, 706, 235

Year	Indiana	Alabama	Tennessee	Iowa	Arkansas	North Carolina	Maryland	Washington	Michigan
1807–1820	----------	----------	----------	----------	----------	------	3, 000	----------	----------
1832	----------	----------	----------	----------	----------	------	12, 000	----------	----------
1840	9, 682	946	558	400	220	3	8, 880	----------	----------
1841	10, 000	1, 000	600	500	----------	------	----------	----------	----------
1842	18, 000	1, 000	1, 000	750	----------	------	2, 104	----------	----------
1843	25, 000	1, 200	4, 500	1, 000	----------	------	12, 421	----------	----------
1844	30, 000	1, 200	10, 000	2, 500	----------	------	18, 345	----------	----------
1845	35, 000	1, 500	18, 000	5, 000	----------	------	30, 372	----------	----------
1846	40, 000	1, 500	25, 000	6, 500	----------	------	36, 707	----------	----------
1847	45, 000	2, 000	30, 000	8, 000	----------	------	65, 222	----------	----------
1848	50, 000	2, 000	40, 000	10, 000	----------	------	98, 032	----------	----------
1849	56, 000	2, 500	52, 000	12, 500	----------	------	175, 497	----------	----------
1850	60, 000	2, 500	60, 000	15, 000	----------	------	242, 517	----------	----------
1851	60, 000	3, 000	70, 000	18, 000	----------	------	317, 460	----------	----------
1852	75, 000	3, 000	75, 000	20, 000	----------	------	411, 707	----------	----------
1853	75, 000	4, 000	85, 000	23, 000	----------	------	657, 862	----------	----------
1854	80, 000	4, 500	90, 000	25, 000	----------	------	812, 727	----------	----------
1855	80, 000	6, 000	100, 000	28, 000	----------	------	735, 137	----------	----------
1856	85, 000	6, 800	115, 000	30, 000	----------	------	817, 659	----------	----------
1857	85, 000	8, 000	125, 000	33, 000	----------	------	654, 017	----------	----------
1858	87, 000	8, 500	135, 000	37, 500	----------	------	722, 686	----------	----------
1859	95, 000	9, 000	150, 000	42, 000	----------	------	833, 349	----------	----------

TABLE 97.—*Coal produced, by States, 1807–1924, net tons*—Continued

Year	Indiana	Alabama	Tennessee	Iowa	Arkansas	North Carolina	Maryland	Washington	Michigan
1860	101,280	10,200	165,300	41,920	200	-------	438,000	5,374	2,320
1861	128,000	10,000	150,000	50,000	----------	-------	287,073	6,000	3,000
1862	150,000	12,500	140,000	53,000	----------	30,000	346,201	7,000	5,000
1863	200,000	15,000	100,000	57,000	----------	30,000	877,313	8,000	8,000
1864	250,000	15,000	100,000	63,000	----------	25,000	755,764	10,000	12,000
1865	280,000	12,000	100,000	69,574	----------	20,000	1,025,208	12,000	15,000
1866	320,000	12,000	100,000	99,320	----------	20,000	1,217,668	13,000	20,000
1867	350,000	10,000	110,000	150,000	----------	20,000	1,381,429	14,500	25,000
1868	375,000	10,000	125,000	241,453	----------	18,000	1,529,879	15,000	28,000
1869	400,000	10,000	130,000	295,105	----------	16,000	2,216,300	16,200	29,980
1870	437,870	11,000	133,418	263,487	----------	15,000	1,819,824	17,844	28,150
1871	600,000	15,000	180,000	300,000	----------	15,000	2,670,338	20,000	32,000
1872	896,000	16,800	224,000	336,000	----------	12,000	2,647,156	23,000	33,600
1873	1,000,000	44,800	350,000	392,000	----------	10,000	3,198,911	26,000	56,000
1874	812,000	50,400	350,000	799,936	----------	-------	2,899,392	30,352	58,000
1875	800,000	67,200	360,000	1,231,547	----------	-------	2,808,018	99,568	62,500
1876	950,000	112,000	550,000	1,250,000	----------	-------	2,126,873	110,342	66,000
1877	1,000,000	196,000	450,000	1,300,000	----------	-------	1,939,575	120,896	69,197
1878	1,000,000	224,000	375,000	1,350,000	----------	-------	2,068,925	131,660	85,322
1879	1,196,490	280,000	450,000	1,400,000	----------	-------	2,132,233	142,666	82,015
1880	1,454,327	323,972	495,131	1,461,116	14,778	350	2,228,917	145,015	100,800
1881	1,984,120	420,000	840,000	1,960,000	20,000	300	2,533,348	196,000	112,000
1882	1,976,470	896,000	850,000	3,920,000	25,000	400	1,555,445	177,340	135,339
1883	2,560,000	1,568,000	1,000,000	4,457,540	50,000	400	2,476,075	244,990	71,296
1884	2,260,000	2,240,000	1,200,000	4,370,566	75,000	500	2,765,617	166,936	36,712
1885	2,375,000	2,492,000	1,440,957	4,012,575	100,000	500	2,833,337	380,250	45,178
1886	3,000,000	1,800,000	1,714,290	4,315,779	125,000	400	2,517,577	423,525	60,434
1887	3,217,711	1,950,000	1,900,000	4,473,828	129,600	300	3,278,023	772,601	71,461
1888	3,140,979	2,900,000	1,967,297	4,952,440	276,871	250	3,479,470	1,215,750	81,407
1889	2,845,057	3,572,983	1,925,689	4,095,358	279,584	222	2,939,715	1,030,578	67,431
1890	3,305,737	4,090,409	2,169,585	4,021,739	399,888	10,262	3,357,813	1,263,689	74,977
1891	2,973,474	4,759,781	2,413,678	3,825,495	542,379	20,355	3,820,239	1,056,249	80,307
1892	3,345,174	5,529,312	2,092,064	3,918,491	535,558	6,679	3,419,962	1,213,427	77,990
1893	3,791,851	5,136,935	1,902,258	3,972,229	574,763	17,000	3,716,041	1,264,877	45,979
1894	3,423,921	4,397,178	2,180,879	3,967,253	512,626	16,900	3,501,428	1,106,470	70,022
1895	3,995,892	5,693,775	2,535,644	4,156,074	598,322	24,900	3,915,585	1,191,410	112,322
1896	3,905,779	5,748,697	2,663,106	3,954,028	675,374	7,813	4,143,936	1,195,504	92,882
1897	4,151,169	5,893,770	2,888,849	4,611,865	856,190	21,280	4,442,128	1,434,112	223,592
1898	4,920,743	6,535,283	3,022,896	4,618,842	1,205,479	11,495	4,674,884	1,884,571	315,722
1899	6,006,523	7,593,416	3,330,659	5,177,479	843,554	26,896	4,807,396	2,029,881	624,708
1900	6,484,086	8,394,275	3,509,562	5,202,939	1,447,945	17,734	4,024,688	2,474,093	849,475
1901	6,918,225	9,099,052	3,633,290	5,617,499	1,816,136	12,000	5,113,127	2,578,217	1,241,241
1902	9,446,424	10,354,570	4,382,968	5,904,766	1,943,932	23,000	5,271,609	2,681,214	964,718
1903	10,791,692	11,654,324	4,798,004	6,419,811	2,229,172	17,309	4,846,165	3,193,273	1,367,619
1904	10,842,189	11,262,046	4,782,211	6,519,933	2,009,451	7,000	4,813,622	3,137,681	1,342,840
1905	11,895,252	11,866,069	5,766,690	6,798,609	1,934,673	1,557	5,108,539	2,864,926	1,473,211
1906	12,092,560	13,107,963	6,259,275	7,266,224	1,864,268	-------	5,435,453	3,276,184	1,346,338
1907	13,985,713	14,250,454	6,810,243	7,574,322	2,670,438	-------	5,532,628	3,680,532	2,035,858
1908	12,314,890	11,604,593	6,199,171	7,161,310	2,078,357	-------	4,377,093	3,024,943	1,835,019
1909	14,834,259	13,703,450	6,358,645	7,757,762	2,377,157	-------	4,023,241	3,602,263	1,784,692
1910	18,389,815	16,111,462	7,121,380	7,928,120	1,905,958	-------	5,217,125	3,911,899	1,534,967
1911	14,201,355	15,021,421	6,433,156	7,331,648	2,106,789	120	4,685,795	3,572,815	1,476,074
1912	15,285,718	16,100,600	6,473,228	7,289,529	2,100,819	200	4,964,038	3,360,932	1,206,230
1913	17,165,671	17,678,522	6,860,184	7,525,936	2,234,107	-------	4,779,839	3,877,891	1,231,786
1914	16,641,132	15,593,422	5,943,258	7,451,022	1,836,540	-------	4,133,547	3,064,820	1,283,030
1915	17,006,152	14,927,937	5,730,361	7,614,143	1,652,106	-------	4,180,477	2,429,095	1,156,138
1916	20,093,528	18,086,197	6,137,449	7,260,800	1,994,915	-------	4,460,046	3,038,588	1,180,360
1917	26,539,329	20,068,074	6,194,221	8,965,830	2,143,579	-------	4,745,924	4,009,902	1,374,805
1918	30,678,634	19,184,962	6,831,048	8,192,195	2,227,369	1,420	4,497,297	4,082,212	1,464,818
1919	20,912,288	15,536,721	5,213,205	5,624,692	1,429,020	6,989	3,021,686	2,990,447	996,545
1920	29,350,585	16,294,099	6,662,428	7,813,916	2,103,596	11,540	4,065,239	3,757,093	1,489,765
1921	20,319,509	12,568,899	4,460,326	4,531,392	1,227,777	23,438	1,827,740	2,428,722	1,141,715
1922	19,132,889	18,324,740	4,876,774	4,335,161	1,110,046	78,570	1,222,707	2,581,165	929,390
1923	26,229,099	20,457,649	6,040,268	5,710,735	1,296,892	36,019	2,285,926	2,926,392	1,172,075
1924	21,480,213	19,130,184	4,556,555	5,468,450	1,451,503	57,094	2,133,703	2,653,667	831,020
	500,015,456	445,127,242	186,396,258	259,571,433	55,032,931	692,195	212,227,971	98,421,543	35,931,372

TABLE 97.—*Coal produced, by States, 1807–1924, net tons*—Continued

Year	Georgia	California	West Virginia	Colorado	Wyoming	Kansas	Utah	Oklahoma (Indian Territory)
1860	1,900	-----	-----	-----	-----	-----	-----	-----
1861	2,[illegible]00	6,620	-----	-----	-----	-----	-----	-----
1862	3,500	23,400	-----	-----	-----	-----	-----	-----
1863	6,000	43,200	444,648	-----	-----	-----	-----	-----
1864	10,000	50,700	454,888	500	-----	-----	-----	-----
1865	10,000	60,530	487,897	1,200	800	-----	-----	-----
1866	8,000	84,020	512,068	6,400	2,500	-----	-----	-----
1867	8,000	124,690	589,360	17,000	5,000	-----	-----	-----
1868	10,000	143,676	609,227	10,500	6,925	-----	-----	-----
1869	12,000	157,234	603,148	8,000	49,382	36,891	-----	-----
1870	15,000	141,890	608,878	4,500	50,000	32,938	5,800	-----
1871	20,000	152,493	618,830	15,600	147,328	41,000	-----	-----
1872	25,000	190,859	700,000	68,540	221,745	44,800	-----	-----
1873	40,000	186,611	1,000,000	69,997	259,700	56,000	-----	-----
1874	60,000	215,352	1,120,000	77,372	219,061	85,000	-----	-----
1875	80,000	166,638	1,120,000	98,838	300,808	150,000	-----	-----
1876	110,000	128,049	896,000	117,666	334,550	225,000	50,400	-----
1877	120,000	107,789	1,120,000	160,000	342,853	300,000	50,400	-----
1878	128,000	134,237	1,120,000	200,630	333,200	375,000	67,200	-----
1879	140,000	147,879	1,400,000	322,732	400,991	460,000	50,000	-----
1880	154,644	236,950	1,829,844	462,747	589,595	771,442	14,748	120,947
1881	168,000	140,000	1,680,000	706,744	420,000	840,000	52,000	150,000
1882	160,000	112,592	2,240,000	1,061,479	707,764	750,000	100,000	200,000
1883	155,000	76,162	2,335,833	1,229,593	779,689	900,000	200,000	350,000
1884	150,000	77,485	3,360,000	1,130,024	902,620	1,100,000	200,000	425,000
1885	150,000	71,615	3,369,062	1,356,062	807,328	1,212,057	213,120	500,000
1886	223,000	100,000	4,005,796	1,368,338	829,355	1,400,000	200,000	534,580
1887	313,715	50,000	4,881,620	1,791,735	1,170,318	1,596,879	180,021	685,911
1888	180,000	95,000	5,498,800	2,185,477	1,481,540	1,850,000	258,961	761,986
1889	225,934	119,820	6,231,880	2,597,181	1,388,947	2,221,043	236,651	752,832
1890	228,337	110,711	7,394,654	3,077,003	1,870,366	2,259,922	318,159	869,229
1891	171,000	93,301	9,220,665	3,512,632	2,327,841	2,716,705	371,045	1,091,032
1892	215,498	85,178	9,738,755	3,510,830	2,503,839	3,007,276	361,013	1,192,721
1893	372,740	72,603	10,708,578	4,102,389	2,439,311	2,652,546	413,205	1,252,110
1894	354,111	67,247	11,627,757	2,831,409	2,417,463	3,388,251	431,550	969,606
1895	260,998	75,453	11,387,961	3,082,982	2,246,911	2,926,870	471,836	1,211,185
1896	238,546	78,544	12,876,296	3,112,400	2,229,624	2,884,801	418,627	1,366,646
1897	195,869	87,992	14,248,159	3,361,703	2,597,886	3,054,012	521,560	1,336,380
1898	244,187	145,888	16,700,999	4,076,347	2,863,812	3,406,555	593,709	1,381,466
1899	233,111	160,915	19,252,995	4,776,224	3,837,392	3,852,267	786,049	1,537,427
1900	315,557	171,708	22,647,207	5,244,364	4,014,602	4,467,870	1,147,027	1,922,298
1901	342,825	151,079	24,068,402	5,700,015	4,485,374	4,900,528	1,322,614	2,421,781
1902	414,083	84,984	24,570,826	7,401,343	4,429,491	5,266,065	1,574,521	2,820,666
1903	416,951	104,673	29,337,241	7,423,602	4,635,293	5,839,976	1,681,409	3,517,388
1904	383,191	78,888	32,406,752	6,658,355	5,178,556	6,333,307	1,493,027	3,046,539
1905	351,991	77,050	37,791,580	8,826,429	5,602,021	6,423,979	1,332,372	2,924,427
1906	332,107	25,290	43,290,350	10,111,218	6,133,994	6,024,775	1,772,551	2,860,200
1907	362,401	13,950	48,091,583	10,790,236	6,252,990	7,322,449	1,947,607	3,642,658
1908	264,822	18,755	41,897,843	9,634,973	5,489,902	6,245,508	1,846,792	2,948,116
1909	211,196	45,836	51,849,220	10,716,936	6,393,109	6,986,478	2,266,899	3,119,377
1910	177,245	11,164	61,671,019	11,973,736	7,533,088	4,921,451	2.517,809	2,646,226
1911	165,210	10,747	59,831,580	10,157,383	6,744,864	6,178,728	2,513,175	3,074,242
1912	227,503	10,978	66,786,687	10,977,824	7,368,124	6,986,182	3,016,149	3,675,418
1913	255,626	24,839	71,254,136	9,232,510	7,393,066	7,202,210	3,254,828	4,165,770
1914	166,498	([a])	71,707,626	8,170,559	6,475,293	6,860,988	3,103,036	3,988,613
1915	134,496	([a])	77,184,069	8,624,980	6,554,028	6,824,474	3,108,715	3,693,580
1916	173,554	([a])	86,460,127	10,484,237	7,910,647	6,881,455	3,567,428	3,608,011
1917	119,028	([a])	86,441,667	12,483,336	8,575,619	7,184,975	4,125,230	4,386,844
1918	66,716	([a])	89,935,839	12,407,571	9,438,688	7,561,947	5,136,825	4,813,447
1919	53,337	([a])	79.036,553	10,323,420	7,219,738	5,224,724	4,631,323	3,802,113
1920	50,156	([a])	89,970,707	12,278,225	9,630,271	5,926,408	6,005,199	4,849,288
1921	33,815	([a])	72,786,996	9,122,760	7,200,666	[b] 3,466,641	4,078,784	3,362,623
1922	60,636	([a])	80,488,192	10,019,597	5,971,724	[b] 2,955,170	4,992,008	2,802,511
1923	75,620	([a])	107,899,941	10,346,218	7,575,031	4,443,149	4,720,217	2,885,038
1924	74,947	([a])	101,662,897	10,444,098	6,757,468	4,247,733	4,488,157	2,329,615
	10,434,101	[c] 5,153,264	1,731,063,638	290,066,699	202,050,091	191,274,425	82,209,756	99,995,847

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[a] Included under "Miscellaneous."

[b] Figures for 1921 and 1922 are incomplete. State Coal Mine Inspection Department reports 4,028,624 tons in 1921 and 3,518,243 tons in 1922.

[c] Total through 1913.

TABLE 97.—*Coal produced, by States, 1807–1924, net tons*—Continued

Year	Oregon	Montana	New Mexico	Texas	North Dakota	Miscellaneous [d]	Total bituminous	Grand total
1807–1820							3, 000	15, 000
1821								1, 322
1822							54, 000	58, 583
1823							60, 000	68, 563
1824							67, 040	80, 725
1825							75, 000	117, 988
1826							88, 720	147, 914
1827							94, 000	172, 151
1828							100, 408	195, 908
1829							102, 000	240, 086
1830							104, 800	320, 072
1831							120, 100	337, 942
1832							146, 500	594, 050
1833							133, 750	734, 657
1834							136, 500	600, 515
1835							134, 000	824, 854
1836							142, 000	984, 832
1837							182, 500	1, 253, 651
1838							445, 452	1, 355, 527
1839							552, 038	1, 560, 360
1840						1, 520	1, 102, 931	2, 070, 039
1841							1, 108, 700	2, 291, 141
1842							1, 244, 494	2, 610, 057
1843							1, 504, 121	3, 060, 874
1844							1, 672, 045	3, 681, 252
1845							1, 829, 872	4, 309, 904
1846							1, 977, 707	4, 865, 522
1847							1, 735, 062	5, 286, 067
1848							1, 968, 032	5, 773, 974
1849							2, 453, 497	6, 448, 831
1850							2, 880, 017	7, 018, 181
1851							3, 253, 460	8, 734, 525
1852							3, 664, 707	9, 816, 664
1853							4, 169, 862	10, 570. 288
1854							4, 582, 227	11, 977, 102
1855							4, 784, 919	12, 926, 673
1856							5, 012, 146	13, 546, 925
1857							5, 153, 622	13, 340, 189
1858							5, 548, 376	13, 974, 478
1859							6, 013, 404	15, 633, 175
1860						3, 800	6, 494, 200	14, 610, 042
1861							6, 688, 358	16, 488, 012
1862							7, 790, 725	17, 485, 835
1863							9, 533, 742	21, 319, 062
1864							11, 066, 474	23, 605, 123
1865							11, 900, 427	23, 792, 173
1866							13, 352, 400	29, 003, 583
1867							14, 722, 313	30, 724, 422
1868							15, 858, 555	32, 861, 960
1869							15, 821, 226	32, 904, 360
1870						1, 425	17, 371, 305	33, 035, 580
1871						5, 629, 869	27, 543, 023	46, 885, 080
1872						176, 159	27, 220, 233	51, 453, 399
1873						1, 939, 567	31, 449, 643	57, 602, 480
1874							27, 787, 130	52, 605, 920
1875						40, 000	29, 862, 554	52, 348, 320
1876						366, 875	30, 486, 755	53, 280, 000
1877						1, 056, 734	34, 841, 444	60, 501, 760
1878						374, 744	36, 245, 918	57, 935, 600
1879							37, 898, 006	68, 105, 799
1880	43, 205	224				200	42, 831, 758	71, 481, 570
1881	33, 600	5, 000	21, 000			76, 900	53, 961, 012	85, 881, 030
1882	35, 000	10, 000	157, 092			6, 502, 359	68, 429, 933	103, 551, 189
1883	40, 000	19, 795	211, 347			6, 870, 075	77, 250, 680	115, 707. 525
1884	45, 000	80, 376	220, 557	125, 000	35, 000	9, 498, 174	82, 998, 704	120, 155, 551

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[d] From 1871 to 1888, inclusive, production reported in this column is due principally to colliery consumption, which in some years was estimated and not included in the distribution by States. Since 1888 small, irregular production from several unimportant sources has been included in this column.

TABLE 97.—*Coal produced, by States, 1807–1924, net tons*—Continued

Year	Oregon	Montana	New Mexico	Texas	North Dakota	Miscellaneous	Total bituminous	Grand total
1885	50, 000	86, 440	306, 202	100, 000	25, 000	----------	72, 824, 321	111, 160, 295
1886	45, 000	49, 846	271, 285	100, 000	25, 955	794, 917	74, 644, 981	113, 680, 427
1887	37, 696	10, 202	508, 034	75, 000	21, 470	1, 237, 195	88, 562, 314	130, 650, 511
1888	75, 000	41, 467	626, 665	90, 000	34, 000	4, 257, 907	102, 040, 093	148, 659, 657
1889	64, 359	363, 301	486, 943	128, 216	28, 907	1, 400	95, 682, 543	141, 229, 513
1890	61, 514	517, 477	375, 777	184, 440	30, 000	807	111, 302, 322	157, 770, 963
1891	51, 826	541, 861	462, 328	172, 100	30, 000	2, 000	117, 901, 238	168, 566, 669
1892	34, 661	564, 648	661, 330	245, 690	40, 725	1, 510	126, 856, 567	179, 329, 071
1893	41, 683	892, 309	665, 094	302, 206	49, 630	----------	128, 385, 231	182, 352, 774
1894	47, 521	927, 395	597, 196	420, 848	42, 015	150	118, 820, 405	170, 741, 526
1895	73, 685	1, 504, 193	720, 654	484, 959	38, 997	200	135, 118, 193	193, 117, 530
1896	101, 721	1, 543, 445	622, 626	544, 015	78, 050	18, 792	137, 640, 276	191, 986, 357
1897	107, 289	1, 647, 882	716, 981	639, 341	77, 246	18, 565	147, 617, 519	200, 229, 199
1898	58, 184	1, 479, 803	992, 288	686, 734	83, 895	17, 039	166, 593, 623	219, 976, 267
1899	86, 888	1, 496, 451	1, 050, 714	883, 832	98, 809	1, 277	193, 323, 187	253, 741, 192
1900	58, 864	1, 661, 775	1, 299, 299	968, 373	129, 883	1, 210	212, 316, 112	269, 684, 027
1901	69, 011	1, 396, 081	1, 086, 546	1, 107, 953	166, 601	1, 300	225, 828, 149	293, 299, 816
1902	65, 648	1, 560, 823	1, 048, 763	901, 912	226, 511	4, 242	260, 216, 844	301, 590, 439
1903	91, 144	1, 488, 810	1, 541, 781	926, 759	278, 645	4, 997	282, 749, 348	357, 356, 416
1904	111, 540	1, 358, 919	1, 452, 325	1, 195, 944	271, 928	4, 174	278, 659, 689	351, 816, 398
1905	109, 641	1, 643, 832	1, 649, 933	1, 200, 684	317, 542	9, 656	315, 062, 785	392, 722, 635
1906	79, 731	1, 829, 921	1, 964, 713	1, 312, 873	305. 689	11, 706	342, 874, 867	414, 157, 278
1907	70, 981	2, 016, 857	2, 628, 959	1, 648, 069	347, 760	17, 727	394, 759, 112	480, 363, 424
1908	86, 259	1, 920, 190	2, 467, 937	1, 895, 377	320, 742	8, 586	332, 573, 944	415, 842, 698
1909	87, 276	2, 553, 940	2, 801, 128	1, 824, 440	422, 047	7, 353	379, 744, 257	460, 814, 616
1910	67, 533	2, 920, 970	3, 508, 321	1, 892, 176	399, 041	5, 448	417, 111, 142	501, 596, 378
1911	46, 661	2, 976, 358	3, 148, 158	1, 974, 593	502, 628	2, 721	405, 907, 059	496, 371, 126
1912	41, 637	3, 048, 495	3, 536, 824	2, 188, 612	499, 480	3, 319	450, 104, 982	534, 466, 580
1913	46, 063	3, 240, 973	3, 708, 806	2, 429, 144	495, 320	14, 789	478, 435, 297	569, 960, 219
1914	51, 558	2, 805, 173	3, 877, 689	2, 323, 773	506, 685	25, 824	422, 703, 970	513, 525, 477
1915	39, 231	2, 789, 755	3, 817, 940	2, 088, 908	528, 078	24, 496	442, 624, 426	531, 619, 487
1916	42, 592	3, 632, 527	3, 793, 011	1, 987, 503	634, 912	29, 199	502, 519, 682	590, 098, 175
1917	28, 327	4, 226, 689	4, 000, 527	2, 355, 815	790, 548	68, 420	551, 790, 563	651, 402, 374
1918	13, 328	4, 532, 505	4, 023, 239	2, 261, 135	719, 733	89, 948	579, 385, 820	678, 211, 904
1919	18, 739	3, 236, 369	3, 138, 756	1, 680, 656	840, 959	81, 645	465, 860, 058	553, 952, 259
1920	20, 717	4, 413, 866	3, 683, 440	1, 615, 015	948, 625	76, 641	568, 666, 683	658, 264, 932
1921	([a])	2, 733, 958	2, 453, 482	972, 839	864, 903	123, 215	415, 921, 950	506, 395, 401
1922	([a])	2, 572, 221	3, 147, 173	1, 106, 007	1, 327, 564	113, 920	422, 268, 099	476, 951, 121
1923	([a])	3, 147, 678	2, 915, 173	1, 187, 329	1, 385, 400	150, 271	564, 564, 662	657, 903, 671
1924	([a])	2, 905, 365	2, 786, 063	1, 147, 011	1, 200, 527	128, 659	483, 686, 538	571, 613, 400
	[b] 2, 380, 313	78, 396, 165	79, 154, 099	45, 375, 281	15, 171, 450	39, 899, 626	12, 817, 456, 378	16, 234, 098, 138

[a] Included under "Miscellaneous."
[b] Total through 1920.

COKE AND BY-PRODUCTS

By F. G. Tryon and Others

INTRODUCTION

SPECIAL STUDY OF MARKETING

This report, issued by the Bureau of Mines, continues the series of annual statistical reviews of the coke industry begun in 1882 by the United States Geological Survey, from which bureau the statistical unit in charge of coal and coke was transferred by Executive order on July 1, 1925. The form of presentation is identical with that used in 1922 and 1923, and as the statistical methods used were exhaustively discussed in the report for 1922[1] the usual text analysis of the tables has been omitted to make room for a special study of the demand for by-products, by R. S. McBride (see pp. 663 to 728). This study, which bears the title "The Marketing of Coal Products," was originally prepared for the domestic commerce division of the Bureau of Foreign and Domestic Commerce, under the supervision of A. Heath Onthank, but it has seemed advisable to the directors of both bureaus that McBride's report should be printed by the Bureau of Mines. Its usefulness is enhanced by appearing under the same cover with the statistical tables of production, to which it frequently refers and upon which it throws a flood of light.

ACKNOWLEDGMENTS

This report is based upon statistical statements from the producers of coke, for whose generous and continuing assistance thanks are cordially extended. Special mention should be made of the courtesy of operators of by-product coke plants in supplying monthly returns of coke output. The railroads have furnished weekly reports of cars of beehive coke loaded which have been indispensable in preparing the current estimates of production of beehive coke and bituminous coal. (See Tables 5 to 7.) For the statistics of imports and exports the Bureau of Mines is indebted to the Bureau of Foreign and Domestic Commerce, from whose records they have been compiled by J. A. Dorsey, of the Bureau of Mines. The statistics of world production of coke in Table 56 have been assembled by L. M. Jones. All the other tables are the joint work of H. L. Bennit, R. M. McKinney, and C. F. Sponseller, under the supervision of the senior author. Particular credit is due Mrs. Bennit, who collected, edited, and tabulated the returns, and Miss McKinney, to whom fell the responsibility of preparing the tables in the absence of Mrs. Bennit.

DEFINITIONS OF TERMS USED IN STATISTICAL TABLES

The standard unit of measurement in the coke industry in the United States is the short or net ton of 2,000 pounds. Unless otherwise specified, this is the unit employed throughout this chapter.

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[1] Mineral Resources, 1922, pt. 2, pp. 671–799.

In this report the term " coke " does not include breeze or the fine coke screenings, because operators in general, especially those in the beehive industry, do not regard this fine material as properly so classified. No effort has been made to define accurately the limitation as to size between coke and breeze. Each operator has followed his own regular practice in reporting his output of fine material to the Bureau of Mines. It is probably safe to say, however, that coke breeze and screenings correspond closely in size to the anthracite usually classified as steam sizes; in other words, they include the material smaller than pea coal.

For reasons explained in the following section, the statistics of by-product coke in this report cover the operations of all by-product coke ovens, including those installed and operated by public utilities engaged primarily in manufacturing gas for city supply.

The tables of the report classify the sales as between " furnace coke," " foundry coke," and " domestic and other coke." These terms are general trade designations referring to physical or chemical properties of the coke quite as much as to the precise uses to which the product is put. Not all foundry coke, for example, finds its way to foundrymen. In the beehive-coke trade furnace coke is commonly 48-hour coke, and foundry coke is supposed to be 72-hour coke, which commonly comes in larger, longer, and harder pieces than furnace coke and is selected with more care to prevent the loading of the soft pieces and black ends. To compensate for this extra work and for the heavier capital charges resulting from the longer coking time, foundry coke commonly sells at 50 cents to $1 a ton more. (See Table 44.) Under the actual conditions of the market the distinction in coking time is not always observed, and some so-called foundry coke is ordinary 48-hour furnace coke from which the soft pieces and black ends have been thrown out.

In the manufacture of by-product coke the universal practice of crushing the coal before coking and the facilities for screening and sizing the coke permit more precise definition of grades. In terms of size, by-product furnace coke is run-of-oven coke from which the breeze and all small coke of less than, say, three-fourths inch in diameter have been removed. By-product foundry coke is a blocky coke whose maximum size is much greater than that of furnace coke and from which all sizes under 2½ to 3 inches are screened out. Domestic coke includes all sizes of approximately 3 inches and under, exclusive of breeze. It may result from the screening of foundry coke or even furnace coke, or where the principal demand is for domestic coke it may be obtained by crushing the larger fragments.

As some furnace coke and considerable foundry or domestic coke is sold for other than metallurgical use, a question was added to the schedule for 1923, asking for the quantity sold " for other industrial use." The replies, tabulated in Tables 35 and 36, are probably incomplete.

ACCOUNTING PRACTICES OF COKE OPERATORS THAT AFFECT STATISTICS

The term " value," as applied to coke in this report, means the value at the ovens. For that part of the output that is sold the value is obviously the amount received for the coke f. o. b. ovens; but a considerable proportion of the coke produced in the United States is made in ovens operated by large corporations that not only mine the coal and make the coke but also have blast furnaces and steel mills that consume the entire product of the ovens. Under such conditions the fixing of a value upon the coke and upon the coal consumed in making it is purely arbitrary. Some corporations charge the coke to the furnace department at cost; others add a percentage of profit or base the reported value on what the coke would cost if purchased.

In the statistics published in this series of reports the value assigned to that part of the output produced but not sold has not always been determined in the same way; therefore the figures of total value of all coke produced are not strictly comparable from year to year. Before 1918 each operator was asked to place his own value on his entire production, including coke used at the plant but not sold. In 1918 and again in 1920 the value of this part of the product was estimated by assigning to the coke produced but not sold in each State a value per ton equal to the average receipts for the coke sold in the same State. In 1919, again in 1921, and in subsequent years the operator was asked to place his own value on the coke used but not sold. These changes in the form of inquiry must be borne in mind in considering Tables 2, 3, 34, 35, 36, 40, 42, and 43.

These differences in accounting practice also affect the relative proportions of the output reported as "sold" and as "used by producer." Between the blast furnaces, which are the largest users of coke, and the coke plants there exists a close business relation, which at many plants amounts to identity of ownership. Among such affiliated interests the line between sales and interdepartmental transfers is difficult to draw, and a large part of the furnace coke reported as sold actually goes to iron furnaces that are in some way connected with the coke companies. (See Tables 35 and 36.)

COKE-PRODUCING INDUSTRIES

Coke is produced in the United States by a group of four industries, which are related in the sense that the product is to some extent interchangeable, but are sharply differentiated as to location, method, equipment, and organization. Besides that produced in the familiar beehive and by-product ovens, coke is obtained in the refining of petroleum, in the manufacture of coal gas, and in the refining of coal tar.

Petroleum coke may be dismissed with a few words. In refining crude oil there is often an ultimate residue in the form of a porous, carbonaceous mass. Its properties are much like those of coke made from coal, except that it is finer in texture, lacks the strength required for metallurgical coke, and is extraordinarily low in ash. The production of petroleum coke in recent years, according to statistics collected by the Bureau of Mines, has been as follows:

Petroleum coke produced and in stock in the United States, 1917–1924, in net tons

Year	Production	Stock at end of year	Year	Production	Stock at end of year
1917	539,366	7,585	1921	604,465	74,508
1918	559,663	22,605	1922	707,064	35,722
1919	603,459	21,146	1923	672,526	26,264
1920	576,613	31,469	1924	761,095	97,844

In the coal-gas industry, as in petroleum refining, the coke obtained is a by-product. The process of carbonization is essentially the same as that in by-product ovens, though the type of oven is different. The coals used are selected for their yield in gas rather than for their coking qualities, and the coke formed is too soft for foundry or furnace use. It is, however, well adapted to the manufacture of water gas, a fact that has led to the common association of coal-gas and water-gas plants. Thus, out of 2,877,787 tons of gas-house coke produced in 1922, 51.8 per cent was used in making water gas, in heating retorts, or for boiler fuel about the plant where it was produced. The remainder, 1,387,658 tons, was sold, largely as domestic fuel, for $12,032,244.

Neither petroleum coke nor gas-house coke is adapted for metallurgical purposes, the use that consumes the great bulk of all the coke produced. Practically, therefore, the coke trade is concerned only with beehive coke and by-product coke, and to them the statistics of this report are confined. Although their product is interchangeable, there are fundamental differences between the beehive and by-product industries which must be kept in mind in examining the tables of this chapter. The competitive relations between the beehive and by-product industries have been discussed in previous reports of this series[2] and need not be treated here. Permanently higher prices for coal and gradually expanding markets for the by-products continue to foster the development of by-product coking, and the manufacture of beehive coke assumes more and more the character of an auxiliary agency called upon to furnish only the peak requirements of the metallurgical industry in times of active business.

Between the coal-gas and the by-product coke industries the line is increasingly difficult to draw. Adaptation of the by-product oven to the needs of city gas manufacture has brought into existence a number of installations of by-product ovens as a part of existing gas utilities. Still other coke plants that are financially independent of public utilities nevertheless supply gas under contract to public-utility distributers. From one point of view these plants are a part of the manufactured-gas industry, but considered with reference to coke-oven design and the technique of coke manufacture, and still more significantly with reference to the supply and demand for coke, they belong to the coke industry.

In the practical operation of a by-product coke plant the fact that the gas may be sold to a public utility and distributed through the city mains is of less consequence than the fact that the coke must be marketed in competition with other coke for foundry, furnace, or household use.

For the purpose of this report all installations of by-product ovens are included as a part of the by-product coke industry, and plants manufacturing coal gas and coke-oven gas on the same premises have been asked to make separate reports for these two branches of their business. The statistics here presented will therefore differ from the tabulations of the Census Bureau, for example, which classifies such installations of coke ovens as a part of the manufactured-gas industry.

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[2] Mineral Resources, 1918, pt. 2, pp. 1446–1447, 1921; 1921, pt. 2, p. 374, 1923.

On pages 798 and 799 of Mineral Resources for 1922, Part II, will be found a summary of the output of manufactured gas and by-products from all sources, including both coke ovens and coal-gas, oil-gas, and water-gas plants, from which the relation of the by-product coke industry to other methods of gas manufacture may be seen.

The principal statistical facts of the coke industry in 1924 are presented in Table 1.

STATISTICAL SUMMARY

TABLE 1.—*Salient figures of the coke industry in 1924*

	By-product	Beehive	Total
Coke produced:			
Quantity net tons	33, 983, 568	10, 286, 037	44, 269, 605
Value	$195, 690, 009	$48, 351, 552	$244, 041, 561
Screenings and breeze produced:			
Quantity net tons	2, 950, 810	375, 130	3, 325, 940
Value	$6, 179, 427	$1, 298, 854	$7, 478, 281
Coal charged into ovens:			
Quantity net tons	49, 061, 339	15, 914, 310	64, 975, 649
Value	$202, 428, 797	$35, 363, 608	$237, 792, 405
Average value	$4. 13	$2. 22	$3. 66
Average yield in per cent of coal charged:			
Coke	69. 3	64. 6	68. 1
Breeze, quantity actually recovered	6. 0	6. 1	6. 0
Ovens:			
In existence Jan. 1	11, 156	62, 349	73, 505
In existence Dec. 31	11, 413	60, 432	71, 845
Dismantled during year	377	2, 231	2, 608
In course of construction Dec. 31	247	----------	247
Daily coke capacity of ovens in existence Dec. 31 net tons	128, 245	(a)	(a)
Coke used by operator in blast furnace or affiliated works:			
Quantity net tons	24, 023, 933	1, 574, 037	25, 597, 970
Value	$125, 838, 387	$7, 872, 356	$133, 710, 743
Disposal of coke:			
Sold for furnace use to affiliated corporations—			
Quantity net tons	2, 335, 056	3, 582, 004	5, 917, 060
Value	$13, 495, 287	$17, 706, 496	$31, 201, 783
Merchant sales of furnace coke—			
Quantity net tons	1, 590, 983	3, 357, 433	4, 948, 416
Value	$9, 149, 521	$13, 507, 138	$22, 656, 659
Sold for foundry use—			
Quantity net tons	1, 553, 849	1, 363, 952	2, 917, 801
Value	$13, 425, 334	$7, 543, 143	$20, 968, 477
Sold for domestic use—			
Quantity net tons	2, 812, 771	139, 886	2, 952, 657
Value	$20, 063, 417	$509, 333	$20, 572, 750
Sold for industrial and other use—			
Quantity net tons	1, 556, 175	260, 046	1, 816, 221
Value	$11, 854, 698	$1, 052, 249	$12, 906, 947
Disposal of screenings and breeze:			
Used by operator—			
Quantity net tons	2, 450, 707	68, 968	2, 519, 675
Value	$4, 798, 998	$94, 713	$4, 893, 711
Sold—			
Quantity net tons	536, 037	32, 190	568, 227
Value	$1, 491, 475	$75, 111	$1, 566, 586
Average receipts per ton sold:			
Furnace coke (merchant sales)	$5. 75	$4. 02	$4. 58
Foundry coke	$8. 64	$5. 53	$7. 19
Domestic coke	$7. 13	$3. 64	$6. 97
Industrial and other coke	$7. 62	$4. 05	$7. 11
Screenings and breeze	$2. 78	$2. 33	$2. 76
By-products produced:			
Gas M cubic feet	541, 101, 050	----------	541, 101, 050
Tar gallons	422, 074, 326	----------	422, 074, 326
Ammonium sulphate or equivalent pounds	1, 089, 245, 167	----------	1, 089, 245, 167
Crude light oil gallons	128, 956, 955	----------	128, 956, 955
Value of by-products sold:			
Gas (surplus)	$49, 784, 947	----------	$49, 784, 947
Tar	$9, 623, 520	----------	$9, 623, 520
Ammonium sulphate or equivalent	$27, 178, 676	----------	$27, 178, 676
Crude light oil and derivatives	$17, 029, 265	----------	$17, 029, 265

[a] Data not available.

TABLE 2.—*Coke produced in by-product and beehive coke ovens in the United States, 1923–24*

[Exclusive of screenings and breeze]

State	By-product								Beehive						Total	
	Plants	Ovens		Coal used (net tons)	Yield of coke from coal (per cent)	Coke produced (net tons)	Value of coke at ovens		Ovens	Coal used (net tons)	Yield of coke from coal (per cent)	Coke produced (net tons)	Value of coke at ovens		Coke produced (net tons)	Value of coke at ovens
		Built	Under construction Dec. 31				Total	Per ton					Total	Per ton		
1923																
Alabama	7	1,196		6,408,843	68.4	4,385,366	$18,156,491	$4.14	6,199	464,160	57.9	268,709	$1,660,903	$6.18	4,654,075	$19,817,394
Colorado	1	120		653,139	68.6	448,243	(a)	(a)	1,758	306,836	65.0	199,580	(a)	(a)	647,823	(a)
Georgia									151	24,161	52.0	12,556	126,690	10.09	12,556	126,690
Illinois	7	899		4,589,863	69.4	3,187,168	30,373,638	9.53							3,187,168	30,373,638
Indiana	6	1,213		7,143,914	70.6	5,042,614	46,765,264	9.27							5,042,614	46,765,264
Kentucky	1	108		582,385	74.5	434,116	(a)	(a)	795	230,539	54.5	125,595	874,752	6.96	559,711	(a)
Maryland	1	300		1,173.062	73.4	861,668	(a)	(a)							861,668	(a)
Massachusetts	1	400		797,833	69.4	554,125	(a)	(a)							554,125	(a)
Michigan	3	390	32	2,286,754	72.1	1,648,773	14,389,742	8.73							1,648,773	14,389,742
Minnesota	3	220		999,924	69.6	695,824	5,104,330	7.34							695,824	5,104,330
Missouri	1	64		(b)	(b)	(b)	(b)	(b)							(b)	(b)
New Jersey	2	252		1,207,605	74.3	897,569	(a)	(a)							897,569	(a)
New Mexico									1,030	(b)	(b)	(b)	(b)	(b)	(b)	(b)
New York	4	598	114	2,607,867	68.4	1,783,948	12,808,335	7.18							1,783,948	12,808,335
Ohio	12	1,619	84	9,290,435	68.1	6,323,810	40,712,282	6.44	205	230,455	65.0	149,796	(a)	(a)	6,473,606	(a)
Oklahoma									300	(b)	(b)	(b)	(b)	(b)	(b)	(b)
Pennsylvania	12	3,094	366	13,407,952	68.5	9,185,747	43,520,249	4.74	37,578	25,177,492	65.3	16,438,539	94,923,942	5.77	25,624,286	138,444,191
Rhode Island	1	40		(b)	(b)	(b)	(b)	(b)							(b)	(b)
Tennessee	1	24		171,703	72.3	124,160	825,542	6.65	1,767	330,831	54.5	180,351	1,244,011	6.90	304,511	2,069,553
Utah			33						819	403,055	57.8	232,941	1,977,669	8.49	232,941	1,977,669
Virginia									3,284	1,241,159	62.4	774,887	5,086,612	6.56	774,887	5,086,612
Washington	1	20		54,811	56.7	31,081	237,148	7.63	408	55,730	68.2	37,987	347,364	9.14	69,068	584,512
West Virginia	4	311		1,400,864	67.2	940,866	5,345,432	5.68	8,055	1,354,982	60.7	821,909	5,758,284	7.01	1,762,775	11,103,716
Wisconsin	2	288		(b)	(b)	(b)	(b)	(b)							(b)	(b)
Combined States				1,498,623	70.2	1,052,586	11,926,300	11.33		264,966	51.7	137,020	1,157,400	8.44	1,189,606	13,083,700
Undistributed							27,426,565	8.54					2,747,953	7.86		71,761,552
	70	11,156	629	54,275,577	69.3	37,597,664	257,591,318	6.85	62,349	30,084,366	64.4	19,379,870	115,905,580	5.98	56,977,534	373,496,898

1924															
Alabama	7	1,196	25	6,375,171	68.8	4,386,372	16,563,223	3.78	6,199	256,240	60.4	154,686	840,843	5.44	4,541,058	17,404,066
Colorado	1	120		754,790	69.3	523,405	([a])	([a])	1,696	330,226	64.2	212,115	([a])	([a])	735,520	([a])
Georgia									151	14,400	56.1	8,081	71,355	8.83	8,081	71,355
Illinois	7	739	110	3,397,248	69.3	2,355,474	20,187,519	8.57							2,355,474	20,187,519
Indiana	6	1,133	19	5,828,314	73.3	4,272,435	30,394,497	7.11							4,272,435	30,394,497
Kentucky	1	108		([b])		([b])	([b])	([b])	795	146,794	54.0	79,248	([a])	([a])	([b])	([b])
Maryland	1	300		1,103,984	73.4	810,118	([a])	([a])							810,118	([a])
Massachusetts	1	400	11	574,632	69.2	397,640	([a])	([a])							397,640	([a])
Michigan	5	420	2	2,408,925	73.5	1,770,547	11,914,028	6.73							1,770,547	11,914,028
Minnesota	3	220		744,567	69.1	514,764	4,903,891	9.53							514,764	4,903,891
Missouri	1	64		([b])		([b])	([b])	([b])							([b])	([b])
New Jersey	2	202		1,202,732	72.3	869,120	([a])	([a])							869,120	([a])
New Mexico									1,030	136,212	61.0	83,070	([a])	([a])	83,070	([a])
New York	5	686	55	2,265,062	70.7	1,600,669	11,108,944	6.94							1,600,669	11,108,944
Ohio	14	1,689		8,422,760	67.9	5,723,074	31,008,209	5.42	205	168,648	65.0	109,625	([a])	([a])	5,832,699	([a])
Oklahoma									300							
Pennsylvania	11	3,420	25	12,555,568	67.1	8,426,155	34,674,512	4.12	36,030	12,989,648	65.4	8,501,282	37,893,584	4.46	16,927,437	72,568,096
Rhode Island	1	40		([b])		([b])	([b])	([b])							([b])	([b])
Tennessee	1	24		103,314	73.3	75,720	376,328	4.97	1,555	249,293	52.9	131,755	635,736	4.83	207,475	1,012,064
Utah	1	33		190,035	51.2	97,350	([a])	([a])	819	268,808	59.4	159,744	1,310,929	8.21	257,094	([a])
Virginia									3,234	769,990	63.0	485,064	2,343,081	4.83	485,064	2,343,081
Washington	1	20		70,968	56.2	39,903	283,710	7.11	408	49,339	64.3	31,712	289,934	9.14	71,615	573,644
West Virginia	4	311		1,484,951	67.3	998,914	4,402,186	4.41	8,010	534,712	61.7	329,655	1,646,452	4.99	1,328,569	6,048,638
Wisconsin	2	288		([b])		([b])	([b])	([b])							([b])	([b])
Combined States				1,578,318	71.1	1,121,908	9,387,943	8.37							1,201,156	9,843,475
Undistributed							20,485,019	7.59					3,319,638	6.86		55,668,263
	75	11,413	247	49,061,339	69.3	33,983,568	195,690,009	5.76	60,432	15,914,310	64.6	10,286,037	48,351,552	4.70	44,269,605	244,041,561

[a] Included under "Undistributed."

[b] Included under "Combined States."

COKE AND COKE BREEZE

GROWTH OF INDUSTRY

TABLE 3.—*Statistics of the manufacture of coke in the United States, 1880–1924*

Year	Plants	Ovens in existence	Coal used (net tons)	Yield of coke from coal (per cent)	Coke produced (net tons)	Value of coke at ovens [a]	
						Total	Per ton
1880	186	12,372	5,237,741	63.7	3,338,300	$6,631,267	$1.99
1890	253	37,158	18,005,209	63.9	11,508,021	23,215,302	2.02
1900	396	58,484	32,113,553	63.9	20,533,348	47,443,331	2.31
1910	578	104,440	63,088,327	66.1	41,708,810	99,742,701	2.39
1911	570	103,879	53,278,248	66.7	35,551,489	84,130,849	2.37
1912	559	102,230	65,577,862	67.1	43,983,599	111,805,113	2.54
1913	551	102,650	69,239,190	66.9	46,299,530	128,922,273	2.78
1914	536	99,755	51,623,750	66.9	34,555,914	88,334,217	2.56
1915	532	99,378	61,832,898	67.2	41,581,150	105,503,868	2.54
1916	499	98,864	81,609,460	66.8	54,533,585	170,841,197	3.13
1917	482	95,896	83,752,371	66.4	55,606,828	298,243,017	5.36
1918	466	93,914	85,028,018	66.4	56,478,372	382,324,368	6.77
1919	464	92,939	65,587,918	67.4	44,180,557	258,339,740	5.85
1920	416	86,179	76,190,832	67.4	51,345,043	475,981,215	9.27
1921	374	77,156	37,188,557	68.0	25,287,622	147,673,095	5.84
1922	366	75,170	54,338,538	68.3	37,124,012	238,313,323	6.42
1923	361	73,505	84,359,943	67.5	56,977,534	373,496,898	6.56
1924	347	71,845	64,975,649	68.1	44,269,605	244,041,561	5.51

Year	By-product coke				Beehive coke			
	Quantity		Value [a]		Quantity		Value [a]	
	Net tons	Per cent	Dollars	Per cent	Net tons	Per cent	Dollars	Per cent
1880	--------	--------	--------	--------	3,338,300	100.0	6,631,267	100.0
1885	--------	--------	--------	--------	5,106,696	100.0	7,629,118	100.0
1890	--------	--------	--------	--------	11,508,021	100.0	23,215,302	100.0
1893	12,850	0.1	(b)	(b)	9,464,730	99.9	(b)	(b)
1900	1,075,727	5.2	2,635,531	5.6	19,457,621	94.8	44,807,800	94.4
1905	3,462,348	10.7	10,851,730	15.0	28,768,781	89.3	61,624,466	85.0
1910	7,138,734	17.1	24,793,016	24.9	34,570,076	82.9	74,949,685	75.1
1911	7,847,845	22.1	27,297,897	32.4	27,703,644	77.9	56,832,952	67.6
1912	11,115,164	25.3	42,632,930	38.1	32,868,435	74.7	69,172,183	61.9
1913	12,714,700	27.5	48,637,852	37.7	33,584,830	72.5	80,284,421	62.3
1914	11,219,943	32.5	38,080,167	43.1	23,335,971	67.5	50,254,050	56.9
1915	14,072,895	33.8	48,558,325	46.0	27,508,255	56.2	56,945,543	54.0
1916	19,069,361	35.0	75,373,070	44.1	35,464,224	65.0	95,468,127	55.9
1917	22,439,280	40.4	138,643,153	46.5	33,167,548	59.6	159,599,864	53.5
1918	25,997,580	46.0	193,018,785	50.5	30,480,792	54.0	189,305,583	49.5
1919	25,137,621	56.9	160,244,768	62.0	19,042,936	43.1	98,094,972	38.0
1920	30,833,951	60.0	313,028,732	65.8	20,511,092	40.0	162,952,483	34.2
1921	19,749,580	78.1	117,506,646	79.6	5,538,042	21.9	30,166,449	20.4
1922	28,550,545	76.9	188,276,767	79.0	8,573,467	23.1	50,036,556	21.0
1923	37,597,664	66.0	257,591,318	69.0	19,379,870	34.0	115,905,580	31.0
1924	33,983,568	76.8	195,690,009	80.2	10,286,037	23.2	48,351,552	19.8

[a] Includes operators' statements of the value of coke consumed by them in associated enterprises but not sold, except that in 1918 and 1920 the value of such coke was estimated for each State at the average value for that State of the part of the product reported sold.

[b] Figures not available.

MONTHLY AND WEEKLY PRODUCTION

TABLE 4.—*By-product coke produced in the United States, 1913–1924, by months, and average per day, in net tons* [a]

Month	1913		1914		1915		1916	
	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average
January	1, 081, 000	35, 000	898, 000	29, 000	858, 000	28, 000	1, 506, 000	49, 000
February	1, 030, 000	37, 000	853, 000	30, 000	844, 000	30, 000	1, 449, 000	50, 000
March	1, 132, 000	37, 000	1, 032, 000	33, 000	971, 000	31, 000	1, 564, 000	50, 000
April	1, 030, 000	34, 000	987, 000	33, 000	1, 027, 000	34, 000	1, 506, 000	50, 000
May	1, 055, 000	34, 000	976, 000	31, 000	1, 084, 000	35, 000	1, 583, 000	51, 000
June	1, 068, 000	36, 000	920, 000	31, 000	1, 098, 000	31, 000	1, 526, 000	51, 000
July	1, 094, 000	35, 000	954, 000	31, 000	1, 196, 000	39, 000	1, 583, 000	51, 000
August	1, 144, 000	37, 000	1, 010, 000	33, 000	1, 281, 000	41, 000	1, 621, 000	52, 000
September	1, 119, 000	37, 000	976, 000	33, 000	1, 337, 000	45, 000	1, 621, 000	54, 000
October	1, 093, 000	35, 000	942, 000	30, 000	1, 421, 000	46, 000	1, 716, 000	55, 000
November	992, 000	33, 000	830, 000	28, 000	1, 450, 000	48, 000	1, 659, 000	55, 000
December	877, 000	28, 000	842, 000	27, 000	1, 506, 000	49, 000	1, 735, 000	56, 000
	12, 715, 000	35, 000	11, 220, 000	31, 000	14, 073, 000	36, 000	19, 069, 000	52, 000

Month	1917		1918		1919		1920	
	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average
January	1, 788, 000	58, 000	1, 638, 000	53, 000	2, 445, 000	79, 000	2, 426, 000	78, 000
February	1, 807, 000	65, 000	1, 534, 000	55, 000	2, 153, 000	77, 000	2, 343, 000	81, 000
March	1, 813, 000	58, 000	2, 028, 000	65, 000	2, 285, 000	74, 000	2, 646, 000	85, 000
April	1, 859, 000	62, 000	2, 002, 000	67, 000	2, 025, 000	68, 000	2, 267, 000	75, 000
May	1, 879, 000	61, 000	2, 106, 000	68, 000	1, 906, 000	61, 000	2, 400, 000	77, 000
June	1, 880, 000	63, 000	2, 080, 000	69, 000	1, 935, 000	65, 000	2, 487, 000	83, 000
July	1, 882, 000	61, 000	2, 288, 000	74, 000	2, 244, 000	72, 000	2, 658, 000	86, 000
August	1, 915, 000	62, 000	2, 366, 000	76, 000	2, 266, 000	73, 000	2, 742, 000	88, 000
September	1, 919, 000	64, 000	2, 392, 000	80, 000	2, 168, 000	72, 000	2, 744, 000	91, 000
October	1, 898, 000	61, 000	2, 547, 000	82, 000	1, 748, 000	56, 000	2, 915, 000	94, 000
November	1, 900, 000	63, 000	2, 496, 000	83, 000	1, 971, 000	66, 000	2, 679, 000	89, 000
December	1, 899, 000	61, 000	2, 521, 000	81, 000	1, 992, 000	64, 000	2, 527, 000	82, 000
	22, 439, 000	61, 000	25, 998, 000	71, 000	25, 138, 000	69, 000	30, 834, 000	84, 000

Month	1921		1922		1923		1924	
	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average
January	2, 259, 000	73, 000	1, 886, 000	61, 000	3, 102, 000	100, 000	3, 093, 000	100, 000
February	1, 872, 000	67, 000	1, 800, 000	64, 000	2, 862, 000	102, 000	2, 980, 000	103, 000
March	1, 757, 000	57, 000	2, 137, 000	69, 000	3, 258, 000	105, 000	3, 220, 000	104, 000
April	1, 506, 000	50, 000	2, 206, 000	74, 000	3, 208, 000	107, 000	3, 009, 000	100. 000
May	1, 577, 000	51, 000	2, 544, 000	82, 000	3, 330, 000	107, 000	2, 807, 000	91, 000
June	1, 396, 000	47, 000	2, 594, 000	86, 000	3, 168, 000	106, 000	2, 425, 000	81, 000
July	1, 286, 000	41, 000	2, 501, 000	81, 000	3, 268, 000	105, 000	2, 369, 000	76, 000
August	1, 371, 000	44, 000	1, 822, 000	59, 000	3, 241, 000	105, 000	2, 445, 000	79, 000
September	1, 411, 000	47, 000	2, 249, 000	75, 000	3, 115, 000	104, 000	2, 545, 000	85, 000
October	1, 720, 000	55, 000	2, 812, 000	91, 000	3, 102, 000	100. 000	2, 899, 000	94, 000
November	1, 751, 000	58, 000	2, 931, 000	98, 000	2, 943, 000	98, 000	2, 926, 000	98, 000
December	1, 844, 000	59, 000	3, 069, 000	99, 000	3, 001, 000	97, 000	3, 266, 000	105, 000
	19, 750, 000	54 000	28, 551, 000	78, 000	37, 598, 000	103, 000	33, 984, 000	93, 000

[a] Exclusive of screenings and breeze. Based upon reports by the operators.

TABLE 5.—*Beehive coke produced in the United States, 1913–1924, by months, and average per working-day, in net tons* [a]

Month	1913		1914		1915		1916	
	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average
January	3, 124, 000	120, 000	2, 105, 000	81, 000	1, 446, 000	55, 000	2, 919, 000	112, 000
February	2, 880, 000	120, 000	2, 137, 000	89, 000	1, 583, 000	66, 000	2, 887, 000	115, 000
March	2, 910, 000	112, 000	2, 653, 000	102, 000	1, 865, 000	69, 000	3, 263, 000	121, 000
April	2, 896, 000	111, 000	2, 343, 000	90, 000	1, 841, 000	71, 000	2, 875, 000	115, 000
May	3, 001, 000	111, 000	1, 993, 000	74, 000	1, 936, 000	74, 000	3, 044, 000	113, 000
June	2, 807, 000	112, 000	1, 890, 000	73, 000	2, 210, 000	85, 000	2, 918, 000	112, 000
July	2, 833, 000	109, 000	1, 977, 000	76, 000	2, 345, 000	90, 000	2, 721, 000	109, 000
August	2, 810, 000	108, 000	1, 888, 000	73, 000	2, 553, 000	98, 000	2, 999, 000	111, 000
September	2, 750, 000	106, 000	1, 793, 000	69, 000	2, 582, 000	99, 000	3, 016, 000	116, 000
October	2, 870, 000	106, 000	1, 665, 000	62, 000	3, 029, 000	116, 000	3, 079, 000	118, 000
November	2, 500, 000	100, 000	1, 363, 000	55, 000	3, 025, 000	116, 000	2, 934, 000	113, 000
December	2, 204, 000	82, 000	1, 529, 000	57, 000	3, 093, 000	119, 000	2, 809, 000	108, 000
	33, 585, 000	108, 000	23, 336, 000	75, 000	27, 508, 000	88, 000	35, 464, 000	114, 000

Month	1917		1918		1919		1920	
	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average
January	2, 923, 000	108, 000	2, 256, 000	84, 000	2, 366, 000	88, 000	1, 946, 000	72, 000
February	2, 490, 000	104, 000	2, 225, 000	93, 000	1, 767, 000	74, 000	1, 705, 000	71, 000
March	3, 139, 000	116, 000	2, 652, 000	102, 000	1, 714, 000	66, 000	1, 976, 000	73, 000
April	2, 814, 000	113, 000	2, 591, 000	100, 000	1, 277, 000	49, 000	1, 579, 000	61, 000
May	2, 861, 000	106, 000	2, 743, 000	102, 000	1, 101, 000	41, 000	1, 671, 000	64, 000
June	2, 755, 000	106, 000	2, 713, 000	109, 000	1, 143, 000	46, 000	1, 683, 000	65, 000
July	2, 754, 000	110, 000	2, 835, 000	109, 000	1, 457, 000	56, 000	1, 666, 000	64, 000
August	2, 650, 000	98, 000	2, 650, 000	98, 000	1, 681, 000	65, 000	1, 749, 000	67, 000
September	2, 727, 000	109, 000	2, 591, 000	104, 000	1, 736, 000	67, 000	1, 731, 000	67, 000
October	2, 780, 000	103, 000	2, 621, 000	97, 000	1, 504, 000	56, 000	1, 716, 000	66, 000
November	2, 677, 000	103, 000	2, 348, 000	90, 000	1, 629, 000	65, 000	1, 605, 000	62, 000
December	2, 598, 000	104, 000	2, 256, 000	90, 000	1, 668, 000	64, 000	1, 484, 000	57, 000
	33, 168, 000	107, 000	30, 481, 000	98, 000	19, 043, 000	61, 000	20, 511, 000	66, 000

Month	1921		1922		1923		1924	
	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average
January	1, 088, 000	42, 000	529, 000	20, 000	1, 594, 000	59, 000	1, 228, 000	45, 000
February	870, 000	36, 000	586, 000	24, 000	1, 598, 000	67, 000	1, 288, 000	52, 000
March	578, 000	21, 000	781, 000	29, 000	1, 886, 000	70, 000	1, 429, 000	55, 000
April	330, 000	13, 000	564, 000	23, 000	1, 914, 000	77, 000	1, 148, 000	44, 000
May	302, 000	12, 000	465, 000	17, 000	1, 972, 000	73, 000	810, 000	30, 000
June	233, 000	9, 000	491, 000	19, 000	1, 892, 000	73, 000	590, 000	24, 000
July	181, 000	7, 000	476, 000	19, 000	1, 706, 000	68, 000	476, 000	18, 000
August	250, 000	9, 000	567, 000	21, 000	1, 611, 000	60, 000	462, 000	18, 000
September	291, 000	11, 000	649, 000	25, 000	1, 480, 000	59, 000	556, 000	21, 000
October	418, 000	16, 000	935, 000	36, 000	1, 391, 000	52, 000	671, 000	25, 000
November	480, 000	18, 000	1, 214, 000	47, 000	1, 189, 000	46, 000	670, 000	27, 000
December	517, 000	20, 000	1, 316, 000	53, 000	1, 147, 000	46, 000	958, 000	37, 000
	5, 538, 000	18, 000	8, 573, 000	28, 000	19, 380, 000	62, 000	10, 286, 000	33, 000

[a] Based on railroad shipments and prorated to the total production reported by operators.

TABLE 6.—*Total coke produced in the United States, 1913–1924, by months, in net tons*

Month	1913	1914	1915	1916	1917	1918
January	4, 205, 000	3, 003, 000	2, 304, 000	4, 425, 000	4, 711, 000	3, 894, 000
February	3, 910, 000	2, 990, 000	2, 427, 000	4, 336, 000	4, 297, 000	3, 759, 000
March	4, 042, 000	3, 685, 000	2, 836, 000	4, 827, 000	4, 952, 000	4, 680, 000
April	3, 926, 000	3, 330, 000	2, 868, 000	4, 381, 000	4, 673, 000	4, 593, 000
May	4, 056, 000	2, 969, 000	3, 020, 000	4, 627, 000	4, 740, 000	4, 849, 000
June	3, 875, 000	2, 810, 000	3, 308, 000	4, 444, 000	4, 635, 000	4, 793, 000
July	3, 927, 000	2, 931, 000	3, 541, 000	4, 304, 000	4, 636, 000	5, 123, 000
August	3, 954, 000	2, 898, 000	3, 834, 000	4, 620, 000	4, 565, 000	5, 016, 000
September	3, 869, 000	2, 769, 000	3, 919, 000	4, 637, 000	4, 646, 000	4, 983, 000
October	3, 963, 000	2, 607, 000	4, 450, 000	4, 795, 000	4, 678, 000	5, 168, 000
November	3, 492, 000	2, 193, 000	4, 475, 000	4, 593, 000	4, 577, 000	4, 844, 000
December	3, 081, 000	2, 371, 000	4, 599, 000	4, 544, 000	4, 497, 000	4, 777, 000
	46, 300, 000	34, 556, 000	41, 581, 000	54, 533, 000	55, 607, 000	56, 479, 000

Month	1919	1920	1921	1922	1923	1924
January	4, 811, 000	4, 372, 000	3, 347, 000	2, 415, 000	4, 696, 000	4, 321, 000
February	3, 920, 000	4, 048, 000	2, 742, 000	2, 386, 000	4, 460, 000	4, 268, 000
March	3, 999, 000	4, 622, 000	2, 335, 000	2, 918, 000	5, 144, 000	4, 649, 000
April	3, 302, 000	3, 846, 000	1, 836, 000	2, 770, 000	5, 122, 000	4, 157, 000
May	3, 007, 000	4, 071, 000	1, 879, 000	3, 009, 000	5, 302, 000	3, 617, 000
June	3, 078, 000	4, 170, 000	1, 629, 000	3, 085, 000	5, 060, 000	3, 015, 000
July	3, 791, 000	4, 324, 000	1, 467, 000	2, 977, 000	4, 974, 000	2, 845, 000
August	3, 947, 000	4, 491, 000	1, 621, 000	2, 389, 000	4, 852, 000	2, 907, 000
September	3, 904, 000	4, 475, 000	1, 702, 000	2, 898, 000	4, 595, 000	3, 101, 000
October	3, 252, 000	4, 631, 000	2, 138, 000	3, 747, 000	4, 493, 000	3, 570, 000
November	3, 600, 000	4, 284, 000	2, 231, 000	4, 145, 000	4, 132, 000	3, 596, 000
December	3, 660, 000	4, 011, 000	2, 361, 000	4, 385, 000	4, 148, 000	4, 224, 000
	44, 181, 000	51, 345, 000	25, 288, 000	37, 124, 000	56, 978, 000	44, 270, 000

TABLE 7.—*Beehive coke produced in the United States in 1924, by weeks*

[Estimated from railroad shipments]

Week ended—	Net tons	Week ended—	Net tons	Week ended—	Net tons
Jan. 1–5	209, 000	May 17	201, 000	Sept. 27	141, 000
12	274, 000	24	167, 000	Oct. 4	147, 000
19	278, 000	31	143, 000	11	135, 000
26	279, 000	June 7	159, 000	18	156, 000
Feb. 2	281, 000	14	139, 000	25	149, 000
9	304, 000	21	139, 000	Nov. 1	159, 000
16	312, 000	28	133, 000	8	149, 000
23	295, 000	July 5	100, 000	15	159, 000
Mar. 1	339, 000	12	112, 000	22	168, 000
8	346, 000	19	110, 000	29	171, 000
15	326, 000	26	106, 000	Dec. 6	185, 000
22	335, 000	Aug. 2	102, 000	13	204, 000
29	314, 000	9	95, 000	20	232, 000
Apr. 5	296, 000	16	101, 000	27	201, 000
12	281, 000	23	115, 000	29–31	137, 000
19	272, 000	30	117, 000		
26	239, 000	Sept. 6	119, 000		10, 286, 000
May 3	218, 000	13	118, 000		
10	189, 000	20	130, 000		

TABLE 8.—*By-product coke produced in the United States, 1923–24, by months and by States, in net tons*[a]

State	January	February	March	April	May	June	July	August	September	October	November	December	Total
1923													
Alabama	362,000	328,000	375.000	369,000	390,000	373,000	382,000	378,000	364,000	363.000	350,000	351,000	4,385,000
Colorado	49,000	45,000	51,000	48,000	50,000	50,000	33,000	22,000	22,000	24,000	22,000	32,000	448,000
Illinois	244,000	227,000	248,000	265,000	290,000	281,000	284,000	281,000	266,000	267,000	259,000	275,000	3,187,000
Indiana	418,000	377,000	426,000	426,000	440,000	414,000	425,000	427,000	409,000	433,000	423,000	425,000	5,043,000
Kentucky	45,000	41,000	44,000	43,000	39,000	32,000	32,000	36,000	39,000	36,000	27,000	20,000	434,000
Maryland	69,000	75.000	97,000	88,000	88,000	62,000	68,000	66,000	60,000	58,000	65,000	66,000	862,000
Massachusetts	41,000	40,000	49,000	47,000	49,000	45,000	50,000	51,000	48,000	50,000	46,000	38,000	554,000
Michigan	127,000	123,000	142,000	137,000	141,000	133,000	140,000	145,000	140,000	142,000	138,000	141,000	1,649,000
Minnesota	58,000	54,000	60,000	57,000	59,000	54,000	55,000	56,000	59,000	63,000	59,000	62,000	696,000
New Jersey	79,000	74,000	77,000	74,000	76,000	71,000	74,000	71,000	74,000	78,000	79,000	70,000	897,000
New York	155,000	135,000	162,000	157,000	157,000	151,000	154,000	153,000	138,000	139,000	136,000	147,000	1,784,000
Ohio	548,000	516,000	573,000	548,000	549,000	503,000	541,000	542,000	517,000	506,000	484,000	492,000	6,324,000
Pennsylvania	722,000	654,000	766,000	770,000	824,000	828,000	851,000	826,000	788,000	758,000	688,000	711,000	9,186,000
Tennessee	12,000	11,000	12,000	12.000	12,000	12.000	12,000	9,000	10,000	9,000	6,000	7,000	124,000
Washington	1,000	3,000	2,000	3,000	3,000	3,000	3,000	3,000	3,000	2,000	2,000	3,000	31,000
West Virginia	73,000	67,000	73,000	71,000	72,000	71,000	84,000	87,000	88,000	86,000	82,000	87,000	941,000
Missouri, Rhode Island, and Wisconsin	99,000	92,000	101,000	93,000	91,000	80,000	80,000	88,000	90,000	88,000	77,000	74,000	1,053,000
	3,102,000	2,862,000	3,258,000	3,208,000	3,330.000	3,168,000	3,268,000	3,241,000	3,115,000	3,102,000	2,943,000	3,001,000	37,598,000
1924													
Alabama	365,000	362,000	388,000	364,000	383,000	355,000	354,000	357,000	349,000	369,000	363,000	377,000	4,386,000
Colorado	37,000	43,000	51.000	52,000	48,000	48,000	51,000	48,000	37,000	37,000	34,000	37,000	523,000
Illinois	272,000	242,000	252,000	248,000	200,000	150,000	144,000	141,000	142,000	168,000	174,000	223,000	2,356,000
Indiana	428,000	407,000	437,000	417,000	393,000	298,000	250,000	253,000	275,000	337,000	348,000	429,000	4,272,000
Maryland	68,000	74,000	93,000	80,000	68,000	45,000	41,000	40,000	54,000	75,000	81,000	91,000	810,000
Massachusetts	37,000	36,000	35,000	31,000	34,000	31,000	30,000	28,000	28,000	33,000	35,000	40,000	398,000
Michigan	146,000	138,000	150,000	146,000	150,000	143,000	148,000	151,000	147,000	152,000	149,000	151,000	1,771,000
Minnesota	60,000	55,000	59,000	48,000	48,000	37,000	33,000	32,000	33,000	38,000	36,000	36,000	515,000
New Jersey	75,000	68,000	69,000	69,000	67,000	73,000	72,000	77,000	75,000	79,000	73,000	72,000	869,000
New York	153,000	146,000	156,000	145,000	131,000	108,000	100,000	97,000	104,000	124,000	160,000	177,000	1,601.000
Ohio	537,000	505,000	573,000	532,000	450,000	403,000	370,000	387,000	415,000	469,000	494,000	588,000	5,723,000
Pennsylvania	711,000	702,000	745,000	688,000	634,000	545,000	600,000	660,000	705,000	816,000	779,000	841,000	8,426,000
Tennessee	7,000	7,000	7,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	7,000	76,000
Utah	----------	----------	----------	2,000	11,000	11,000	12,000	11,000	12,000	13,000	12,000	13,000	97,000
Washington	3,000	3,000	4,000	3,000	3,000	3,000	3,000	3,000	3,000	4,000	4,000	4,000	40,000
West Virginia	91,000	85,000	92,000	89,000	92,000	84,000	72,000	73,000	80,000	85,000	80,000	76,000	999,000
Kentucky, Missouri, Rhode Island, and Wisconsin	103,000	107,000	109,000	89,000	89,000	85,000	83,000	81,000	80,000	94,000	98,000	104,000	1,122,000
	3,093,000	2,980,000	3,220,000	3,009,000	2,807,000	2,425,000	2,369,000	2,445,000	2,545,000	2,899,000	2,926,000	3,266,000	33,984,000

[a] Based upon reports from all producers.

PRODUCTION BY FURNACE AND NONFURNACE OVENS

TABLE 9.—*Number and production of by-product coke plants connected with iron furnaces and by all other plants, 1913–1924* [a]

Year	Number of active plants		Coke produced (net tons)		Percentage of production	
	Furnace plants	Other plants	Furnace plants	Other plants	Furnace plants	Other plants
1913	21	15	9, 346, 855	3, 367, 845	73. 5	26. 5
1914	23	14	8, 029, 727	3, 190, 216	71. 6	28. 4
1915	24	16	10, 448, 015	3, 624, 880	74. 2	25. 8
1916	29	17	14, 446, 576	4, 622, 785	75. 8	24. 2
1917	33	19	17, 321, 145	5, 118, 135	77. 2	22. 8
1918	39	21	20, 124, 218	5, 873, 362	77. 4	22. 6
1919	43	22	20, 019, 097	5, 118, 524	79. 6	20. 4
1920	45	23	25, 212, 745	5, 621, 206	81. 8	18. 2
1921	45	22	16, 231, 374	3, 518, 206	82. 2	17. 8
1922	43	21	23, 889, 702	4, 660, 843	83. 7	16. 3
1923	44	21	31, 117, 323	6, 480, 341	82. 8	17. 2
1924	47	24	28, 165, 902	5, 817, 666	82. 9	17. 1

[a] For classification of individual plants as "furnace" and "other" see Table 24.

TABLE 10.—*Monthly and average daily production of by-product coke by plants associated with iron furnaces and by all other plants, 1922–1924, in net tons* [a]

	1922		1923		1924	
	Furnace plants	Other plants	Furnace plants	Other plants	Furnace plants	Other plants
Monthly production:						
January	1, 555, 000	331, 000	2, 573, 000	529, 000	2, 573, 000	520, 000
February	1, 501, 000	299, 000	2, 360, 000	502, 000	2, 501, 000	479, 000
March	1, 781, 000	356, 000	2, 695, 000	563, 000	2, 716, 000	504, 000
April	1, 846, 000	360, 000	2, 655, 000	553, 000	2, 527, 000	482, 000
May	2, 176, 000	368, 000	2, 759, 000	571, 000	2, 259, 000	548, 000
June	2, 222, 000	372, 000	2, 638, 000	530, 000	1, 969, 000	456, 000
July	2, 152, 000	349, 000	2, 726, 000	542, 000	1, 925, 000	444, 000
August	1, 463, 000	359, 000	2, 687, 000	554, 000	1, 956, 000	489, 000
September	1, 859, 000	390, 000	2, 565, 000	550, 000	2, 099, 000	446, 000
October	2, 343, 000	469, 000	2, 553, 000	549, 000	2, 414, 000	485, 000
November	2, 436, 000	495, 000	2, 422, 000	521, 000	2, 452, 000	474, 000
December	2, 546, 000	523, 000	2, 484, 000	517, 000	2, 775, 000	491, 000
	23, 880, 000	4, 671, 000	31, 117, 000	6, 481, 000	28, 166, 000	5, 818, 000
Average daily production:						
January	50, 200	10, 700	83, 000	17, 000	83, 000	17, 000
February	53, 600	10, 700	84, 000	18, 000	86, 000	17, 000
March	57, 400	11, 500	87, 000	18, 000	88, 000	16, 000
April	61, 500	12, 000	89, 000	18, 000	84, 000	16, 000
May	70, 200	11, 900	89, 000	18, 000	73, 000	18, 000
June	74, 100	12, 400	88, 000	18, 000	66, 000	15, 000
July	69, 400	11, 300	88, 000	17, 000	62, 000	14, 000
August	47, 200	11, 600	87, 000	18, 000	63, 000	16, 000
September	62, 000	13, 000	85, 000	18, 000	70, 000	15, 000
October	75, 600	15, 100	82, 000	18, 000	78, 000	16, 000
November	81, 200	16, 500	81, 000	17, 000	82, 000	16, 000
December	82, 100	16, 900	80, 000	17, 000	89, 000	16, 000
Average	65, 400	12, 800	85, 000	18, 000	77, 000	16, 000

[a] For classification of individual plants as "furnace" and "other" see Table 24.

Table 11.—*Percentage of total monthly output of by-product coke produced by plants associated with iron furnaces and by other plants, 1921–1924* [a]

Month	1921		1922		1923		1924	
	Furnace plants	Other plants	Furnace plants	Other plants	Furnace plants	Other plants	Furnace plants	Other plants
January	83.1	16.9	82.4	17.6	83.0	17.0	83.2	16.8
February	82.3	17.7	83.3	16.7	82.5	17.5	83.9	16.1
March	81.3	18.7	83.3	16.7	82.7	17.3	84.3	15.7
April	80.3	19.7	83.7	16.3	82.8	17.2	84.0	16.0
May	81.1	18.9	85.5	14.5	82.9	17.1	80.5	19.5
June	82.6	17.4	85.7	14.3	83.3	16.7	81.2	18.8
July	81.2	18.8	86.0	14.0	83.4	16.6	81.3	18.7
August	83.0	17.0	80.3	19.7	82.9	17.1	80.0	20.0
September	83.8	16.2	82.7	17.3	82.3	17.7	82.5	17.5
October	84.0	16.0	83.3	16.7	82.3	17.7	83.3	16.7
November	84.2	15.8	83.1	16.9	82.3	17.7	83.8	16.2
December	84.9	15.1	82.9	17.1	82.8	17.2	85.0	15.0
	82.2	17.8	83.7	16.3	82.8	17.2	82.9	17.1

[a] For classification of individual plants as "furnace" and "other" see Table 24.

PRODUCTION BY STATES AND DISTRICTS

Table 12.—*Coke produced in the United States, 1921–1924, in net tons*

State	1921	1922	1923	1924	Increase or decrease, 1924 from 1923
Alabama	2,534,039	3,799,865	4,654,075	4,541,058	−113,017
Colorado	368,131	484,039	647,823	735,520	+87,697
Georgia	6,943	8,832	12,556	8,081	−4,475
Illinois	1,322,178	1,982,906	3,187,168	2,355,474	−831,694
Indiana	3,091,263	3,995,505	5,042,614	4,272,435	−770,179
Kentucky	284,825	487,167	559,711	(a)	(a)
Maryland	292,439	589,893	861,668	810,118	−51,550
Massachusetts	294,059	407,081	554,125	397,640	−156,485
Michigan	777,125	1,142,059	1,648,773	1,770,547	+121,774
Minnesota	435,866	462,044	695,824	514,764	−181,060
Missouri	(a)	(a)	(a)	(a)	(a)
New Jersey	739,768	790,811	897,569	869,120	−28,449
New Mexico	(a)	87,631	(a)	83,070	(a)
New York	746,916	1,494,992	1,783,948	1,600,669	−183,279
Ohio	3,028,423	5,011,138	6,473,606	5,832,699	−640,907
Oklahoma	----------	----------	(a)	----------	(a)
Pennsylvania	9,769,476	13,991,892	25,624,286	16,927,437	−8,696,849
Rhode Island	(a)	(a)	(a)	(a)	(a)
Tennessee	85,728	113,896	304,511	207,475	−97,036
Utah	(a)	172,453	232,941	257,094	+24,153
Virginia	280,476	378,656	774,887	485,064	−289,823
Washington	27,260	31,674	69,068	71,615	+2,547
West Virginia	397,892	919,744	1,762,775	1,328,569	−434,206
Wisconsin	(a)	(a)	(a)	(a)	(a)
Combined States	804,815	771,734	1,189,606	1,201,156	−465,091
	25,287,622	37,124,012	56,977,534	44,269,605	−12,707,929

[a] Included under "Combined States."

TABLE 13.—*By-product and beehive coke produced in the United States, 1918 and 1921–1924, in net tons*

State	1918	1921	1922	1923	1924
By-product					
Alabama	2, 634, 451	2, 401, 127	3, 493, 656	4, 385, 366	4, 386, 372
Colorado	230, 663	286, 755	364, 678	448, 243	523, 405
Illinois	2, 285, 610	1, 322, 178	1, 982, 906	3, 187, 168	2, 355, 474
Indiana	3, 898, 215	3, 091, 263	3, 995, 505	5, 042, 614	4, 272, 435
Kentucky	517, 749	185, 383	456, 645	434, 116	(a)
Maryland	474, 368	292, 439	589, 893	861, 668	810, 118
Massachusetts	556, 397	294, 059	407, 081	554, 125	397, 640
Michigan	(a)	777, 125	1, 142, 059	1, 648, 773	1, 770, 547
Minnesota	784, 065	435, 866	462, 044	695, 824	514, 764
Missouri	(a)	(a)	(a)	(a)	(a)
New Jersey	682, 148	739, 768	790, 811	897, 569	869, 120
New York	1, 069, 587	746, 916	1, 494, 992	1, 783, 948	1, 600, 669
Ohio	5, 226, 334	2, 966, 273	4, 911, 670	6, 323, 810	5, 723, 074
Pennsylvania	4, 586, 981	5, 303, 371	7, 151, 912	9, 185, 747	8, 426, 155
Rhode Island	------------	(a)	(a)	(a)	(a)
Tennessee	124, 469	57, 723	27, 454	124, 160	75, 720
Utah	------------	------------	------------	------------	97, 350
Washington	30, 129	23, 765	5, 611	31, 081	39, 903
West Virginia	603, 393	188, 355	501, 894	940, 866	998, 914
Wisconsin	(a)	(a)	(a)	(a)	(a)
Combined States	2, 293, 021	637, 214	771, 734	1, 052, 586	1, 121, 908
	25, 997, 580	19, 749, 580	28, 550, 545	37, 597, 664	33, 983, 568
Beehive					
Alabama	1, 717, 721	132, 912	306, 209	268, 709	154, 686
Colorado	758, 784	81, 376	119, 361	199, 580	212, 115
Georgia	22, 048	6, 943	8, 832	12, 556	8, 081
Kentucky	301, 036	99, 442	30, 522	125, 595	79, 248
New Mexico	597, 072	(a)	87, 631	(a)	83, 070
Ohio	138, 909	62, 150	99, 468	149, 796	109, 625
Oklahoma	(a)	------------	------------	(a)	------------
Pennsylvania	22, 136, 664	4, 466, 105	6, 839, 980	16, 438, 539	8, 501, 282
Tennessee	302, 637	28, 005	86, 442	180, 351	131, 755
Utah	(a)	(a)	172, 453	232, 941	159, 744
Virginia	1, 234, 256	280, 476	378, 656	774, 887	485, 064
Washington	93, 659	3, 495	26, 063	37, 987	31, 712
West Virginia	2, 716, 613	209, 537	417, 850	821, 909	329, 655
Combined States	461, 393	167, 601	------------	137, 020	------------
	30, 480, 792	5, 538, 042	8, 573, 467	19, 379, 870	10, 286, 037

(a) Included under "Combined States."

TABLE 14.—*Rank of the States in the production of coke, 1920–1924*

State	1920		1921		1922		1923		1924	
	All coke	By-product coke	All coke	By-product coke	All coke	By-product coke	All coke	By-product coke	All coke	By-product coke
Pennsylvania	1	1	1	1	1	1	1	1	1	1
Ohio	2	2	3	3	2	2	2	2	2	2
Alabama	4	4	4	4	4	4	4	4	3	3
Indiana	3	3	2	2	3	3	3	3	4	4
Illinois	5	5	5	5	5	5	5	5	5	5
Michigan	7	6	6	6	7	7	8	7	6	6
New York	8	7	7	7	6	6	6	6	7	7
West Virginia	6	15	10	15	8	10	7	8	8	8
New Jersey	12	8	8	8	9	8	9	9	9	9
Maryland	14	10	14	12	10	9	10	10	10	10
Colorado	10	12	11	13	12	15	13	14	11	11
Minnesota	15	11	9	9	13	11	12	11	12	12
Virginia	9	------	16	------	16	------	11	------	13	------
Wisconsin	13	9	12	10	14	13	14	12	14	13
Massachusetts	16	13	13	11	15	14	16	13	15	14
Kentucky	11	14	15	16	11	12	15	15	16	15
Utah	20	------	18	------	18	------	19	------	17	18
Missouri	19	16	17	14	17	16	18	16	18	16
Tennessee	17	17	20	18	20	18	17	18	19	19
Rhode Island	21	18	19	17	19	17	20	17	20	17
New Mexico	18	------	22	------	21	------	21	------	21	------
Washington	22	19	21	19	22	19	22	19	22	20
Georgia	23	------	23	------	23	------	23	------	23	------
Oklahoma	------	------	------	------	------	------	24	------	------	------

TABLE 15.—*By-product and beehive coke produced in Pennsylvania, 1923–24, by districts*

District	Plants	Ovens		Coal used (net tons)	Yield of coke from coal (per cent)	Coke produced (net tons)	Value of coke at ovens	
		Built	Under construction				Total	Per ton
1923								
By-product:								
Eastern Pennsylvania[a]	5	844	-------	3, 463, 148	71. 8	2, 486, 464	$17, 829, 569	$7. 17
Western Pennsylvania[b]	7	2, 250	366	9, 944, 804	67. 4	6, 699, 283	25, 690, 680	3. 83
	12	3, 094	366	13, 407, 952	68. 5	9, 185, 747	43, 520, 249	4. 74
Beehive:								
Allegheny Mountain and Allegheny Valley	7	698	-------	308, 248	64. 2	198, 042	1, 391, 601	7. 03
Connellsville	66	15, 341	-------	11, 411, 725	66. 4	7, 580, 817	44, 079, 103	5. 81
Lower Connellsville	56	12, 557	-------	8, 739, 859	65. 4	5, 719, 608	32, 312, 919	5. 65
Pittsburgh	11	3, 381	-------	1, 902, 126	60. 0	1, 142, 129	6, 027, 389	5. 28
Upper Connellsville	12	1, 702	-------	778, 367	65. 3	508, 654	3, 274, 688	6. 44
Other districts[c]	13	3, 899	68	2, 037, 167	63. 3	1, 289, 289	7, 838, 242	6. 08
	165	37, 578	68	25, 177, 492	65. 3	16, 438, 539	94, 923, 942	5. 77
Grand total	177	40, 672	434	38, 585, 444	66. 4	25, 624, 286	138, 444, 191	5. 40
1924								
By-product:								
Eastern Pennsylvania[a]	4	804	25	2, 553, 859	70. 1	1, 790, 175	11, 143, 168	6. 22
Western Pennsylvania[b]	7	2, 616	-------	10, 001, 709	66. 3	6, 635, 980	23, 531, 344	3. 55
	11	3, 420	25	12, 555, 568	67. 1	8, 426, 155	34, 674, 512	4. 12
Beehive:								
Allegheny Mountain and Allegheny Valley	6	598	-------	147, 596	65. 2	96, 190	505, 972	5. 26
Connellsville	63	15, 256	-------	5, 484, 692	66. 3	3, 638, 895	17, 186, 869	4. 72
Lower Connellsville	53	12, 258	-------	4, 788, 835	66. 2	3, 167, 880	12, 086, 645	3. 82
Pittsburgh	5	2, 345	-------	1, 071, 509	59. 5	637, 934	3, 010, 853	4. 72
Upper Connellsville	12	1, 674	-------	470, 320	63. 7	299, 740	1, 427, 602	4. 76
Other districts[c]	13	3, 899	-------	1, 026, 696	64. 3	660, 643	3, 675, 643	5. 56
	152	36, 030	-------	12, 989, 648	65. 4	8, 501, 282	37, 893, 584	4. 46
Grand total	163	39, 450	25	25, 545, 216	66. 3	16, 927, 437	72, 568, 096	4. 29

[a] 1923: Includes plants at Bethlehem, Steelton, Lebanon, Chester, and Swedeland; 1924: Bethlehem, Steelton, Lebanon, and Swedeland.

[b] Includes plants at Glassport, Johnstown, Clairton, Farrell, Dunbar, Pittsburgh, and Midland.

[c] Includes Bedford, Clearfield, Huntingdon, Jefferson, and parts of Indiana and Westmoreland Counties.

TABLE 16.—*Coke shipped from the Connellsville and Lower Connellsville districts, Pa., 1915, 1918, and 1921–1924, in net tons* [a]

Month	1915	1918	1921	1922	1923	1924
January	940, 781	1, 021, 055	735, 897	377, 003	1, 046, 630	937, 790
February	1, 045, 739	991, 871	552, 568	397, 537	1, 048, 425	921, 070
March	1, 258, 559	1, 436, 821	361, 646	584, 497	1, 292, 435	1, 024, 770
April	1, 268, 292	1, 459, 248	198, 966	377, 433	1, 270, 355	800, 420
May	1, 310, 639	1, 532, 634	186, 256	247, 145	1, 342, 545	504, 740
June	1, 486, 845	1, 438, 700	130, 324	276, 304	1, 306, 750	303, 370
July	1, 618, 199	1, 578, 130	92, 880	283, 472	1, 196, 660	243, 090
August	1, 657, 203	1, 492, 065	158, 250	371, 499	1, 144, 790	205, 430
September	1, 683, 414	1, 423, 236	188, 664	451, 240	1, 005, 200	263, 520
October	1, 851, 938	1, 410, 403	257, 499	628, 333	914, 800	329, 430
November	1, 873, 405	1, 136, 355	303, 532	799, 087	781, 690	451, 950
December	1, 926, 202	1, 160, 072	405, 935	872, 950	754, 060	668, 980
	17, 921, 216	16, 080, 590	3, 572, 417	5, 666, 500	13, 104, 340	6, 654, 560

[a] Statistics from the Weekly Courier, Connellsville, Pa.

TABLE 17.—*By-product and beehive coke produced in West Virginia, 1923–24, by districts*

District	Plants	Ovens		Coal used (net tons)	Yield of coke from coal (per cent)	Coke produced (net tons)	Value of coke at ovens	
		Built	Under construction				Total	Per ton
1923								
By-product:								
Fairmont, Benwood, Follansbee, and Weirton	4	[a] 311	-------	1, 400, 864	67.2	940, 866	$5, 345, 432	$5.6
Beehive:								
Flat Top	12	1, 944	-------	256, 496	58.1	148, 954	1, 019, 571	6.84
Tug River	1	2, 137	-------	-------	-------	-------	-------	-------
Kanawha	4	583	-------	264, 025	62.1	163, 936	1, 104, 403	6.74
New River	11	1, 188	-------	367, 255	59.2	217, 255	1, 930, 697	8.89
Upper Monongahela and Panhandle	20	1, 596	-------	349, 278	60.2	210, 384	1, 206, 197	5.73
Upper Potomac and Tygarts Valley	6	607	-------	117, 928	69.0	81, 380	497, 416	6.11
	54	8, 055	-------	1, 354, 982	60.7	821, 909	5, 758, 284	7.01
Grand total	58	8, 366	-------	2, 755, 846	64.0	1, 762, 775	11, 103, 716	6.30
1924								
By-product:								
Fairmont, Benwood, Follansbee, and Weirton	4	[a] 311	-------	1, 484, 951	67.3	998, 914	4, 402, 186	4.41
Beehive:								
Flat Top	12	1, 989	-------	127, 168	61.6	78, 396	321, 828	4.11
Tug River	1	2, 137	-------	-------	-------	-------	-------	-------
Kanawha	4	583	-------	46, 469	63.5	29, 504	139, 590	4.73
New River	10	1, 146	-------	186, 247	59.5	110, 765	815, 955	7.37
Upper Monongahela and Panhandle	18	1, 548	-------	150, 780	62.4	94, 100	305, 779	3.25
Upper Potomac and Tygarts Valley	6	607	-------	24, 048	70.2	16, 890	63, 300	3.75
	51	8, 010	-------	534, 712	61.7	329, 655	1, 646, 452	4.99
Grand total	55	8, 321	-------	2, 019, 663	65.8	1, 328, 569	6, 048, 638	4.55

[a] 191 Koppers and 120 Semet-Solvay ovens.

TABLE 18.—*By-product and beehive coke produced in Ohio, 1923–24, by districts*

District	Plants	Ovens		Coal used (net tons)	Yield of coke from coal (per cent)	Coke produced (net tons)	Value of coke at ovens	
		Built	Under construction				Total	Per ton
1923								
By-product:								
Canton and Cleveland	4	531	-------	3,096,778	69.0	2,138,014	$14,628,530	$6.84
Youngstown	3	594	-------	3,168,680	66.0	2,090,220	13,832,569	6.62
Other districts [a]	5	494	84	3,024,977	69.3	2,095,576	12,251,183	5.85
	12	1,619	84	9,290,435	68.1	6,323,810	40,712,282	6.44
Beehive	2	205	-------	230,455	65.0	149,796	([b])	([b])
Grand total	14	1,824	84	9,520,890	68.0	6,473,606	([b])	([b])
1924								
By-product:								
Canton and Cleveland	4	531	-------	2,876,552	69.2	1,990,222	11,697,913	5.88
Youngstown	3	594	-------	2,791,061	66.1	1,845,635	9,050,821	4.90
Other districts [a]	7	564	-------	2,755,147	68.5	1,887,217	10,259,475	5.44
	14	1,689	-------	8,422,760	67.9	5,723,074	31,008,209	5.42
Beehive	2	205	-------	168,648	65.0	109,625	([b])	([b])
Grand total	16	1,894	-------	8,591,408	67.9	5,832,699	([b])	([b])

[a] 1923: Includes plants at Dover, Ironton, Lorain, Portsmouth, and Toledo; 1924: Includes also plants at Painesville and Warren.

[b] Bureau of Mines not at liberty to publish figures.

NUMBER AND TYPE OF OVENS

TABLE 19.—*By-product coke ovens built and under construction in the United States at end of each year, 1921–1924*

State	1921		1922		1923		1924	
	Built	Under construction	Built	Under construction	Built	Under construction	Built	Under construction
Alabama	1,141	30	1,196	----------	1,196	----------	1,196	25
Colorado	120	----------	120	----------	120	----------	120	----------
Illinois	894	5	899	----------	899	----------	739	110
Indiana	1,213	----------	1,213	----------	1,213	----------	1,133	19
Kentucky	108	----------	108	----------	108	----------	108	----------
Maryland	300	----------	300	----------	300	----------	300	----------
Massachusetts	400	----------	400	----------	400	----------	400	11
Michigan	390	----------	390	----------	390	32	420	2
Minnesota	220	----------	220	----------	220	----------	220	----------
Missouri	64	----------	64	----------	64	----------	64	----------
New Jersey	252	----------	252	----------	252	----------	202	----------
New York	732	----------	692	----------	598	114	686	55
Ohio	1,558	----------	1,558	----------	1,619	84	1,689	----------
Pennsylvania	3,154	----------	3,154	366	3,094	366	3,420	25
Rhode Island	40	----------	40	----------	40	----------	40	----------
Tennessee	24	----------	24	----------	24	----------	24	----------
Utah	----------	----------	----------	----------	----------	33	33	----------
Washington	20	----------	20	----------	20	----------	20	----------
West Virginia	274	----------	274	37	311	----------	311	----------
Wisconsin	238	50	288	----------	288	----------	288	----------
	11,142	85	11,212	403	11,156	629	11,413	247

TABLE 20.—*Beehive coke ovens in the United States at the end of each year, 1918 and 1920–1924*

State	1918	1920	1921	1922	1923	1924	
						Built	Under construction
Alabama	8, 586	8, 482	6, 717	6, 460	6, 199	6, 199	----------
Colorado	2, 724	1, 793	1, 758	1, 758	1, 758	1, 696	----------
Georgia	201	151	151	151	151	151	----------
Kansas	2	----------	----------	----------	----------	----------	----------
Kentucky	1, 077	855	855	795	795	795	----------
New Mexico	1, 154	1, 030	1, 030	1, 030	1, 030	1, 030	----------
Ohio	272	222	205	205	205	205	----------
Oklahoma	304	300	300	300	300	300	----------
Pennsylvania	48, 588	44, 569	39, 806	38, 593	37, 578	36, 030	----------
Tennessee	2, 328	1, 848	1, 848	1, 822	1, 767	1, 555	----------
Utah	819	819	819	819	819	819	----------
Virginia	4, 042	3, 906	3, 474	3, 372	3, 284	3, 234	----------
Washington	408	407	408	408	408	408	----------
West Virginia	14, 130	10, 916	8, 643	8, 245	8, 055	8, 010	----------
	84, 635	75, 298	66, 014	63, 958	62, 349	60, 432	----------

TABLE 21.—*Coke ovens completed and abandoned and total number in existence and under construction at the end of 1924*

State	Plants in existence	Ovens						
		New [a]		Abandoned during year	In existence Dec. 31		Under construction Dec. 31	
		Number	Capacity per day (net tons of coke)		Number	Capacity per day (net tons of coke)	Number	Capacity per day (net tons of coke)
By-product								
Alabama	7	----------	----------	----------	1, 196	13, 135	25	266
Colorado	1	----------	----------	----------	120	1, 680	----------	----------
Illinois	7	----------	----------	160	739	8, 864	110	1, 800
Indiana	6	----------	----------	80	1, 133	14, 242	19	190
Kentucky	1	----------	----------	----------	108	1, 400	----------	----------
Maryland	1	----------	----------	----------	300	4, 667	----------	----------
Massachusetts	1	----------	----------	----------	400	1, 750	11	104
Michigan	5	30	233	----------	420	5, 393	2	850
Minnesota	3	----------	----------	----------	220	2, 413	----------	----------
Missouri	1	----------	----------	----------	64	813	----------	----------
New Jersey	2	----------	----------	50	202	2, 206	----------	----------
New York	5	135	2, 160	47	686	6, 903	55	822
Ohio	14	70	1, 210	----------	1, 689	21, 061	----------	----------
Pennsylvania	11	366	5, 300	40	3, 420	36, 083	25	350
Rhode Island	1	----------	----------	----------	40	510	----------	----------
Tennessee	1	----------	----------	----------	24	336	----------	----------
Utah	1	33	450	----------	33	450	----------	----------
Washington	1	----------	----------	----------	20	109	----------	----------
West Virginia	4	----------	----------	----------	311	3, 130	----------	----------
Wisconsin	2	----------	----------	----------	288	3, 100	----------	----------
	75	[b] 634	[b] 9, 353	377	11, 413	128, 245	247	4, 382
Beehive								
Alabama	21	----------	----------	----------	6, 199	(c)	----------	----------
Colorado	7	----------	----------	97	1, 696		----------	----------
Georgia	1	----------	----------	----------	151		----------	----------
Kentucky	4	----------	----------	----------	795		----------	----------
New Mexico	3	----------	----------	----------	1, 030		----------	----------
Ohio	2	----------	----------	----------	205		----------	----------
Oklahoma	2	----------	----------	----------	300		----------	----------
Pennsylvania	152	----------	----------	1, 782	36, 030		----------	----------
Tennessee	10	----------	----------	212	1, 555		----------	----------
Utah	1	----------	----------	----------	819		----------	----------
Virginia	13	----------	----------	50	3, 234		----------	----------
Washington	5	----------	----------	----------	408		----------	----------
West Virginia	51	----------	----------	90	8, 010		----------	----------
	272	----------	----------	2, 231	60, 432	(c)	----------	----------

[a] Represents new construction. Does not include ovens repaired and put into commission.
[b] Excludes 133 old ovens repaired and put into commission.
[c] Data not available.

TABLE 22.—*By-product coke plants in the United States, December 31, 1924*

State	Town	Name of company owning plant	Type of plant[a]	Number of ovens	Type of oven	Year put in operation[b]
Alabama	Alabama City	Gulf States Steel Co	F	37	Koppers	1917
	Birmingham	Alabama By-Products Corp.	M	75	do	1920–1923
	do	Sloss Sheffield Steel & Iron Co.	F	120	Semet-Solvay	1920
	Ensley	Semet-Solvay Co	F	240	do	1898–1902
	Fairfield	Tennessee Coal, Iron & R. R. Co.	F	434	Koppers	1912–1920
	Tuscaloosa	Central Iron & Coal Co	F	60	Semet-Solvay	1906–1914
	Woodward	Woodward Iron Co	F	170	Koppers	1911–1922
	do	do	F	60	Wilputte	1917
Colorado	Pueblo	Colorado Fuel & Iron Co.	F	120	Koppers	1918
Illinois	Chicago	Chicago By-Product Coke Co.	M	105	do	1921–22
	Granite City	St. Louis Coke & Iron Co.	F	80	Roberts	1921
	Joliet	Illinois Steel Co	F	280	Koppers	1908–9
	Lockport	Coal Products Manufacturing Co.	M	18	Wilputte	1914
	do	do	M	35	Koppers	1912
	South Chicago	By-Products Coke Corp	M	120	Semet-Solvay	1905–1915
	do	International Harvester Co	F	88	Wilputte	1919
	Waukegan	North Shore Gas Co	M	13	Semet-Solvay	1912
Indiana	Gary	Illinois Steel Co	F	700	Koppers	1911–1918
	Indiana Harbor.	Inland Steel Co	F	130	do	1913–1917
	do	Youngstown Sheet & Tube Co.	F	120	Semet-Solvay	1919
	Indianapolis	Citizens Gas Co	M	50	United-Otto	1909–1913
	do	do	M	41	Semet-Solvay	1914
	do	do	M	40	Wilputte	1919
	Muncie	Central Indiana Gas Co	M	22	Klönne	1912
	Terre Haute	Indiana Coke & Gas Co	M	30	Koppers	1919
Kentucky	Ashland	Ashland By-Products Coke Co.	F	108	Semet-Solvay	1913–1916
Maryland	Sparrows Point	Bethlehem Steel Co	F	300	Koppers	1914–1919
Massachusetts	Everett	New England Fuel & Transportation Co	M	400	United-Otto	1899
Michigan	Battle Creek	Battle Creek Gas Co	M	11	Koppers	1924
	Dearborn	Ford Motor Co	F	120	Semet-Solvay	1919
	Detroit	Solvay Process Co	M	216	do	1901–1917
	Wyandotte	Michigan Alkali Co	M	54	United-Otto	1902–1916
	Zilwaukee	Consumers Power Co	M	19	Koppers	1924
Minnesota	Duluth	Minnesota Steel Co	F	90	do	1915–16
	St. Paul	Minnesota By-Product Coke Co.	M	65	do	1918
	West Duluth	Zenith Furnace Co	F	65	United-Otto	1904–1916
Missouri	St. Louis	Laclede Gas Light Co	M	56	Koppers	1915
	do	do	M	8	Piette	1921
New Jersey	Camden	Camden Coke Co	M	37	Koppers	1921
	Kearny	Seaboard By-Product Coke Co.	M	165	do	1917–1919
New York	Buffalo	Donner-Hanna Coke Corp.	F	150	do	1920
	do	Wickwire Spencer Steel Corp.	F	60	Semet-Solvay	1917
	Geneva	Empire Gas & Electric Co	M	46	do	1904–1909
	Lackawanna	Bethlehem Steel Co	F	60	do	1920
	do	do	F	235	Rothberg	
	do	do	F	114	Koppers	1924
	Utica	Utica Gas & Electric Co.	M	21	do	1924
Ohio	Canal Dover	Hanna Furnace Co	F	24	Roberts	1916
	Canton	United Alloy Steel Corp.	F	47	Koppers	1916
	Cleveland	American Steel & Wire Co.	F	180	do	1918
	do	McKinney Steel Co	F	204	do	1916
	do	Otis Steel Co	F	100	Semet-Solvay	1910–1915
	East Youngstown.	Youngstown Sheet & Tube Co.	F	306	Koppers	1916–1918
	Ironton	Ironton By-Product Coke Co.	F	60	Semet-Solvay	1918

[a] F, "Furnace plants," or plants associated with iron furnaces and steel works. M, "Nonfurnace plants" or "other plants" (see Tables 9–11), including merchant plants, plants associated with industries other than iron and steel, and plants supplying gas under contract for city use.

[b] The first and last years are given for those plants that have two or more installations.

Table 22.—*By-product coke plants in the United States, December 31, 1924*—Continued

State	Town	Name of company owning plant	Type of plant	Number of ovens	Type of oven	Year put in operation
Ohio (contd.)	Lorain	National Tube Co	F	208	Koppers	1918
	Painesville	Diamond Alkali Co	F	23	do	1924
	Portsmouth	Portsmouth By-Product Coke Co.	F	108	Semet-Solvay	1917
	Toledo	Toledo Furnace Co	F	94	Koppers	1916
	Warren	Trumbull-Cliffs Furnace Co.	F	47	do	1924
	Youngstown	Republic Iron & Steel Co	F	204	do	1914–1923
	do	Youngstown Sheet & Tube Co.	F	84	do	1917
Pennsylvania	Bethlehem	Bethlehem Steel Co	F	424	do	1915–16
	Clairton	Carnegie Steel Co	F	1,134	do	1918–1924
	Dunbar	American Manganese Manufacturing Co.	F	110	Semet-Solvay	1896–1903
	Farrell	Carnegie Steel Co	F	212	Otto-Hoffman	1903
	Glassport	Allegheny By-Product Coke Co.	M	120	United-Otto	1897
	Johnstown	Bethlehem Steel Co	F	150	Otto-Hoffman	1895–1907
	do	do	F	92	Koppers	1915
	do	do	F	310	Cambria	1918–1921
	do	do	F	88	Semet-Solvay	1921
	Lebanon	do	F	90	do	1904–1921
	Midland	Pittsburgh Crucible Steel Co.	F	100	Koppers	1920
	Pittsburgh	Jones & Laughlin Steel Co.	F	300	do	1919–20
	Steelton	Bethlehem Steel Co	F	120	Semet-Solvay	1907
	do	do	F	60	Koppers	1918
	Swedeland	Rainey-Wood Coke Co	F	110	do	1919
Rhode Island	Providence	Providence Gas Co	M	40	do	1919
Tennessee	Altonpark	Chattanooga Coke & Gas Co.	M	24	Semet-Solvay	1915
Utah	Provo	Columbia Steel Corp	F	33	Koppers	1924
Washington	Seattle	Seattle Lighting Co	M	20	Klönne	1914
West Virginia	Benwood	National Tube Co	F	120	Semet-Solvay	1898–1901
	Fairmont	Domestic Coke Corp	M	60	Koppers	1920
	Follansbee	Wheeling Steel Corp	F	94	do	1917
	Weirton	Weirton Steel Co	F	37	do	1923
Wisconsin	Mayville	Youngstown Sheet & Tube Co.	F	108	Otto-Hoffman	1914–1917
	Milwaukee	Milwaukee Coke & Gas Co.	M	80	Semet-Solvay	1901–1906
	do	do	M	100	Koppers	1921–22

Table 23.—*By-product ovens under construction in the United States, December 31, 1924*

State	Town	Name of company owning plant	Number of ovens	Type of oven	Date of operation
Alabama	Tarrant	Alabama By-Products Corp.	25	Koppers	March, 1925.
Illinois	Chicago	By-Products Coke Corp	110	do	February, 1925.
Indiana	Fort Wayne	Northern Indiana Gas & Electric Co.	19	do	June, 1925.
Massachusetts	Lynn	Lynn Gas & Electric Co	11	do	April, 1925.
Michigan	Dearborn	Ford Motor Co	2	Piron	May, 1925.
New York	Troy	Hudson Valley Coke & Products Corp.	55	American	September, 1925.
Pennsylvania	Chester	Philadelphia Suburban Gas & Electric Co.	25	Morrisey	June, 1925.

TABLE 24.—*By-product ovens of each type in the United States at the end of the year in 1923 and 1924*

State	Koppers	Semet-Solvay	United Otto [a]	Rothberg	Gas machinery	Roberts	Klönne	Wilputte	Piette	Cambria-Belgian	Total
1923											
Alabama	716	420						60			1,196
Colorado	120										120
Illinois	420	293				80		106			899
Indiana	860	161	100		30		22	40			1,213
Kentucky		108									108
Maryland	300										300
Massachusetts			400								400
Michigan		336	54								390
Minnesota	155		65								220
Missouri	56								8		64
New Jersey	202		50								252
New York	150	166		282							598
Ohio	1,327	268				24					1,619
Pennsylvania	1,854	448	482							310	3,094
Rhode Island	40										40
Tennessee		24									24
Washington							20				20
West Virginia	191	120									311
Wisconsin	100	80	108								288
	6,491	2,424	1,259	282	30	104	42	206	8	310	11,156
1924											
Alabama	716	420						60			1,196
Colorado	120										120
Illinois	420	133				80		106			739
Indiana	860	161	50				22	40			1,133
Kentucky		108									108
Maryland	300										300
Massachusetts			400								400
Michigan	30	336	54								420
Minnesota	155		65								220
Missouri	56								8		64
New Jersey	202										202
New York	285	166		235							686
Ohio	1,397	268				24					1,689
Pennsylvania	2,220	408	482							310	3,420
Rhode Island	40										40
Tennessee		24									24
Utah	33										33
Washington							20				20
West Virginia	191	120									311
Wisconsin	100	80	108								288
	7,125	2,224	1,159	235		104	42	206	8	310	11,413

[a] Includes the Otto-Hoffmann and Schniewind types.

CAPACITY OF BY-PRODUCT OVENS

TABLE 25.—*Estimated annual potential production of coke and coal required for charge of by-product coke ovens in the United States, 1920, 1922, 1923, and 1924, when operated at different percentages of maximum capacity, in millions of net tons*

Percentage of maximum capacity	1920		1922		1923				1924			
					Ovens completed Dec. 31 [b]		Including ovens under construction		Ovens completed Dec. 31		Including ovens under construction	
	Coke	Coal [a]	Coke	Coal [a]	Coke	Coal [a]	Coke	Coal [a]	Coke	Coal [a]	Coke	Coal [a]
100	42.8	61.2	43.8	62.6	45.1	64.4	48.7	69.6	46.3	66.1	47.9	68.4
90	38.5	55.0	39.4	56.3	40.6	58.0	43.8	62.6	41.7	59.5	43.1	61.6
85	36.4	52.0	37.2	53.2	38.3	54.7	41.4	59.2	39.4	56.2	40.7	58.1
75	32.1	45.9	32.9	47.0	33.8	48.3	36.5	52.2	34.7	49.6	35.9	51.3
50	21.4	30.6	21.9	31.3	22.6	32.2	24.4	34.8	23.2	33.1	24.0	34.2

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[a] Coal for charge estimated on basis of 70 per cent yield in coke.

[b] The indicated increase in capacity from Dec. 31, 1922, to Dec. 31, 1923, is due not to the construction of new ovens, but to an upward revision of the rated capacity of certain plants as reported by the operators.

TABLE 26.—*Percentage of maximum capacity produced by by-product coke operators, 1920–1924, by months*

	1920	1921	1922	1923	1924		1920	1921	1922	1923	1924
January	72. 0	62. 3	50. 4	83. 2	81. 4	August	78. 1	37. 5	48. 2	86. 5	61. 1
February	74. 1	57. 3	53. 4	85. 0	83. 8	September	80. 7	39. 7	62. 3	85. 9	65. 7
March	77. 4	48. 6	57. 4	87. 2	84. 8	October	82. 8	45. 9	75. 4	82. 8	71. 7
April	67. 2	42. 7	59. 2	88. 7	81. 4	November	77. 8	48. 4	81. 2	81. 1	74. 8
May	68. 7	43. 4	68. 1	89. 1	73. 1	December	69. 5	49. 7	82. 2	80. 1	80. 8
June	73. 4	39. 4	69. 2	87. 6	65. 3						
July	75. 8	35. 1	66. 7	87. 2	59. 2	The year	74. 8	45. 8	64. 6	85. 4	73. 4

QUANTITY AND COST OF COAL CHARGED

TABLE 27.—*Total quantity and value at ovens of coal used in the manufacture of coke in the United States, 1923–24, by States*

State	Coal used (net tons)	Cost of coal		Coal per ton of coke	
		Total	Per ton of coal	Net tons	Cost
1923					
By-product plants					
Alabama	6, 408, 843	$18, 954, 008	$2. 95	1. 45	$4. 28
Colorado	653, 139	(a)	(a)	1. 46	--------
Illinois	4, 589, 863	26, 507, 580	5. 78	1. 47	8. 50
Indiana	7, 143, 914	41, 284, 147	5. 77	1. 41	8. 14
Maryland	1, 173, 062	(a)	(a)	1. 36	--------
Massachusetts	797, 833	(a)	(a)	1. 44	--------
Michigan	2, 286, 754	13, 245, 431	5. 79	1. 39	8. 05
Minnesota	999, 924	6, 741, 767	6. 74	1. 43	9. 64
New Jersey	1, 207, 605	(a)	(a)	1. 34	--------
New York	2, 607, 867	13, 851, 717	5. 31	1. 46	7. 75
Ohio	9, 290, 435	44, 973, 898	4. 84	1. 46	7. 05
Pennsylvania	13, 407, 952	50, 514, 662	3. 77	1. 46	5. 50
Tennessee	171, 703	601, 278	3. 50	1. 38	4. 83
Washington	54, 811	298, 248	5. 44	1. 76	9. 57
West Virginia	1, 400, 864	5, 638, 695	4. 03	1. 49	6. 00
Kentucky, Missouri, Rhode Island, and Wisconsin	2, 081, 008	12, 533, 360	6. 02	1. 40	8. 43
Undistributed	----------	23, 256, 199	5. 27	----------	--------
	54, 275, 577	258, 400, 990	4. 76	1. 44	6. 85
Beehive plants					
Alabama	464, 160	1, 299, 385	2. 80	1. 72	4. 82
Colorado	306, 836	(a)	(a)	1. 54	--------
Georgia	24, 161	99, 788	4. 13	1. 93	7. 97
Kentucky	230, 539	572, 665	2. 48	1. 84	4. 56
Ohio	230, 455	(a)	(a)	1. 54	--------
Pennsylvania	25, 177, 492	62, 220, 652	2. 47	1. 54	3. 80
Tennessee	330, 831	961, 119	2. 91	1. 84	5. 35
Utah	403, 055	1, 309, 926	3. 25	1. 72	5. 59
Virginia	1, 241, 159	3, 453, 525	2. 78	1. 61	4. 48
Washington	55, 730	312, 944	5. 61	1. 47	8. 25
West Virginia	1, 354, 982	3, 599, 475	2. 66	1. 65	4. 39
New Mexico and Oklahoma	264, 966	1, 073, 471	4. 05	1. 94	7. 86
Undistributed	----------	2, 134, 160	3. 97	----------	--------
	30, 084, 366	77, 037, 110	2. 56	1. 55	3. 97

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[a] Included under "Undistributed."

TABLE 27.—*Total quantity and value at ovens of coal used in the manufacture of coke in the United States, 1923–24, by States*—Continued

State	Coal used (net tons)	Cost of coal		Coal per ton of coke	
		Total	Per ton of coal	Net tons	Cost
1924					
By-product plants					
Alabama	6,375,171	$18,172,290	$2.85	1.45	$4.13
Colorado	754,790	(a)	(a)	1.44	--------
Illinois	3,397,248	17,513,155	5.16	1.44	7.43
Indiana	5,828,314	30,503,110	5.23	1.36	7.11
Maryland	1,103,984	(a)	(a)	1.36	--------
Massachusetts	574,632	(a)	(a)	1.45	--------
Michigan	2,408,925	12,863,772	5.34	1.36	7.26
Minnesota	744,567	4,385,629	5.89	1.45	8.54
New Jersey	1,202,732	(a)	(a)	1.38	--------
New York	2,265,062	10,761,218	4.75	1.42	6.75
Ohio	8,422,760	34,051,160	4.04	1.47	5.94
Pennsylvania	12,555,568	40,037,692	3.19	1.49	4.75
Tennessee	103,314	343,669	3.33	1.36	4.53
Utah	190,035	(a)	(a)	1.95	--------
Washington	70,968	382,303	5.39	1.78	9.59
West Virginia	1,484,951	5,671,284	3.82	1.49	5.69
Kentucky, Missouri, Rhode Island, and Wisconsin	1,578,318	7,675,331	4.86	1.41	6.85
Undistributed	-----------	20,068,184	5.24	----------	--------
	49,061,339	202,428,797	4.13	1.44	5.95
Beehive plants					
Alabama	256,240	670,800	2.62	1.66	4.35
Colorado	330,226	(a)	(a)	1.56	--------
Georgia	14,400	44,259	3.07	1.78	5.46
Kentucky	146,794	(a)	(a)	1.85	--------
New Mexico	136,212	(a)	(a)	1.64	--------
Ohio	168,648	(a)	(a)	1.54	--------
Pennsylvania	12,989,648	27,578,841	2.12	1.53	3.24
Tennessee	249,293	565,390	2.27	1.88	4.27
Utah	268,808	873,626	3.25	1.68	5.46
Virginia	769,990	1,758,763	2.28	1.59	3.63
Washington	49,339	237,725	4.82	1.56	7.52
West Virginia	534,712	981,951	1.84	1.62	2.98
Undistributed	-----------	2,652,253	3.39	----------	--------
	15,914,310	35,363,608	2.22	1.55	3.44

[a] Included under "Undistributed."

TABLE 28.—*Average cost per net ton of coal charged into by-product coke ovens, 1915–1924*

State	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924
Alabama	$1.65	$1.89	$2.54	$3.29	$3.35	$4.10	$3.29	$2.47	$2.95	$2.85
Illinois	2.87	2.93	3.81	4.63	4.73	6.49	5.90	5.92	5.78	5.16
Indiana	2.94	3.05	3.87	4.50	4.63	5.92	5.89	5.70	5.77	5.23
Kentucky	1.47	1.52	2.55	3.34	3.40	4.84	4.20	4.28	(a)	(a)
Michigan	2.38	2.48	3.63	4.51	4.60	7.03	5.77	5.65	5.79	5.34
Minnesota	2.72	2.94	4.01	5.31	4.33	6.50	7.12	6.79	6.74	5.89
New York	2.50	2.73	4.33	4.46	4.34	6.20	5.86	5.60	5.31	4.75
Ohio	1.88	2.56	4.36	3.98	3.85	5.75	4.94	5.04	4.84	4.04
Pennsylvania	2.01	2.47	3.29	3.74	2.99	3.91	3.39	3.78	3.77	3.19
Tennessee	1.64	1.66	2.08	3.59	3.64	4.30	3.84	3.84	3.50	3.33
Washington	3.34	3.38	3.87	5.72	5.89	6.63	6.53	5.50	5.44	5.39
West Virginia	1.88	2.00	3.30	3.57	3.18	4.82	3.89	4.07	4.03	3.82
Average	2.33	2.60	3.70	4.23	3.96	5.40	4.84	4.73	4.76	4.13
Cost of coal per ton of coke	3.24	3.62	5.20	6.00	5.65	7.73	7.03	6.81	6.85	5.95

[a] Bureau of Mines not at liberty to publish.

TABLE 29.—*Cost of coal and value of all products per net ton of coke produced, 1913–1924*

[All figures reduced to value per net ton of coke produced]

Year	By-product coke					Beehive coke		
		Per ton of coke					Per ton of coke	
	Value of coke per ton [a]	Value of all by-products	Total value of products	Cost of coal	Excess, products over coal	Value of coke per ton [a]	Cost of coal	Excess, coke over coal
1913	$3.82	$1.41	$5.23	$3.27	$1.96	$2.39	$1.75	$0.64
1914	3.39	1.65	5.04	3.19	1.85	2.15	1.67	.48
1915	3.45	2.19	5.64	3.24	2.40	2.07	1.61	.46
1916	3.95	3.25	7.20	3.62	3.58	2.69	1.96	.73
1917	6.18	3.01	9.19	5.20	3.99	4.81	3.17	1.64
1918	7.42	3.07	10.49	6.00	4.49	6.21	3.65	2.56
1919	6.37	2.72	9.09	5.65	3.44	5.15	3.39	1.76
1920	10.15	3.40	13.55	7.73	5.82	7.94	4.90	3.04
1921	5.95	3.46	9.41	7.03	2.38	5.45	3.82	1.63
1922	6.59	3.32	9.91	6.81	3.10	5.84	4.05	1.79
1923	6.85	3.48	10.33	6.85	3.48	5.98	3.97	2.01
1924	5.76	3.51	9.27	5.95	3.32	4.70	3.44	1.26

[a] Includes operators' statements of the value of coke consumed by them in associated enterprises but not sold, except that in 1918 and 1920 the value of such coke was estimated for each State at the average value for that State of the part of the product reported sold.

PREPARATION AND SOURCE OF COAL CHARGED

TABLE 30.—*Coal used in the manufacture of by-product and beehive coke in the United States, 1921–1924, in net tons*

State	1921	1922	1923	1924		
				Unwashed	Washed	Total
By-product ovens:						
Alabama	3,476,923	5,115,981	6,408,843	146,192	6,228,979	6,375,171
Colorado	417,112	528,956	653,139	----------	754,790	754,790
Illinois	1,952,358	2,876,987	4,589,863	3,378,559	18,689	3,397,248
Indiana	4,342,467	5,509,297	7,143,914	5,726,132	102,182	5,828,314
Kentucky	257,854	629,012	582,385	(a)	----------	(a)
Maryland	395,526	799,630	1,173,062	1,103,984	----------	1,103,984
Massachusetts	399,935	606,589	797,833	574,632	----------	574,632
Michigan	1,103,524	1,578,357	2,286,754	2,374,849	34,076	2,408,925
Minnesota	630,173	688,007	999,924	744,567	----------	744,567
Missouri	(a)	(a)	(a)	(a)	----------	(a)
New Jersey	1,064,960	1,084,781	1,207,605	1,202,732	----------	1,202,732
New York	1,098,014	2,208,162	2,607,867	2,063,651	201,411	2,265,062
Ohio	4,375,992	7,133,358	9,290,435	8,422,760	----------	8,422,760
Pennsylvania	7,865,395	10,363,792	13,407,952	11,598,644	956,924	12,555,568
Rhode Island	(a)	(a)	(a)	(a)	----------	(a)
Tennessee	79,911	37,061	171,703	30,994	72,320	103,314
Utah	----------	----------	----------	190,035	----------	190,035
Washington	43,570	9,390	54,811	----------	70,968	70,968
West Virginia	277,345	757,877	1,400,864	1,120,795	364,156	1,484,951
Wisconsin	(a)	(a)	(a)	(a)	----------	(a)
Combined States	932,052	1,125,433	1,498,623	1,578,318	----------	1,578,318
	28,713,111	41,052,670	54,275,577	40,256,844	8,804,495	49,061,339
Beehive ovens:						
Alabama	223,119	509,661	464,160	----------	256,240	256,240
Colorado	123,828	183,627	306,836	14,051	316,175	330,226
Georgia	12,708	16,178	24,161	2,424	11,976	14,400
Kentucky	161,507	53,660	230,539	146,794	----------	146,794
New Mexico	(a)	141,340	(a)	----------	136,212	136,212
Ohio	99,787	153,034	230,455	168,648	----------	168,648
Oklahoma	----------	----------	(a)	----------	----------	----------
Pennsylvania	6,722,491	10,416,729	25,177,492	11,199,922	1,789,726	12,989,648
Tennessee	54,328	174,945	330,831	----------	249,293	249,293
Utah	(a)	299,499	403,055	268,808	----------	268,808
Virginia	442,038	601,528	1,241,159	694,547	75,443	769,990
Washington	6,291	40,825	55,730	----------	49,339	49,339
West Virginia	343,226	694,842	1,354,982	490,310	44,402	534,712
Combined States	286,123	----------	264,966	----------	----------	----------
	8,475,446	13,285,868	30,084,366	12,985,504	2,928,806	15,914,310

[a] Included under "Combined States."

Table 31.—*Coal consumed at beehive-coke plants, 1923–24, classified with respect to practice in crushing coal before charging, in net tons*

State and district	At plants practicing crushing [a]	At plants not practicing crushing	Total
1923			
Alabama	369,822	94,338	464,160
Colorado	292,544	14,292	306,836
Georgia		24,161	24,161
Kentucky	230,539		230,539
New Mexico and Oklahoma	264,966		264,966
Ohio		230,455	230,455
Pennsylvania:			
Allegheny Mountain and Allegheny Valley district	115,929	192,319	308,248
Connellsville district	61,699	11,941,875	12,003,574
Lower Connellsville district	2,018,374	6,129,636	8,148,010
Pittsburgh district	1,551,768	350,358	1,902,126
Upper Connellsville district	502,014	276,353	778,367
Other districts	1,865,034	172,133	2,037,167
Total Pennsylvania	6,114,818	19,062,674	25,177,492
Tennessee	302,331	28,500	330,831
Utah	403,055		403,055
Virginia	1,241,159		1,241,159
Washington	55,730		55,730
West Virginia:			
Flat Top district	147,029	109,467	256,496
Kanawha district	264,025		264,025
New River district	172,338	194,917	367,255
Upper Monongahela district	86,487	36,639	123,126
Upper Potomac and Tygarts Valley district	327,307	16,773	344,080
Total West Virginia	997,186	357,796	1,354,982
Total United States	10,272,150	19,812,216	30,084,366
1924			
Alabama	187,781	68,459	256,240
Colorado	316,175	14,051	330,226
Georgia		14,400	14,400
Kentucky	146,794		146,794
New Mexico	136,212		136,212
Ohio		168,648	168,648
Pennsylvania:			
Allegheny Mountain and Allegheny Valley district	86,754	60,842	147,596
Connellsville district	48,837	5,435,855	5,484,692
Lower Connellsville district	939,680	3,849,155	4,788,835
Pittsburgh district	958,113	113,396	1,071,509
Upper Connellsville district	360,689	109,631	470,320
Other districts	1,026,696		1,026,696
Total Pennsylvania	3,420,769	9,568,879	12,989,648
Tennessee	212,393	36,900	249,293
Utah	268,808		268,808
Virginia	716,069	53,921	769,990
Washington	40,668	8,671	49,339
West Virginia:			
Flat Top district	23,152	104,016	127,168
Kanawha district	46,469		46,469
New River district	105,595	80,652	186,247
Upper Monongahela district	129,694	21,086	150,780
Upper Potomac and Tygarts Valley district	23,488	560	24,048
Total West Virginia	328,398	206,314	534,712
Total United States	5,774,067	10,140,243	15,914,310

[a] Includes a small number of plants that reported charging slack or screenings.

TABLE 32.—*Coal used in the manufacture of by-product coke, 1923–24, by sources, in net tons*

State in which coal was used	Coal produced in—						
	Alabama	Arkansas	Colorado	Illinois	Indiana	Kentucky	Oklahoma
1923							
Alabama	6,609,431						
Colorado			702,369				
Illinois				773,046	159,662	2,070,094	
Indiana				473,322	556,458	1,450,984	
Michigan						979,866	
Minnesota		235			446	126,896	156
New York						217,089	
Ohio						2,429,005	
Kentucky, Missouri, Rhode Island, and Wisconsin					4,391	897,071	
	6,609,431	235	702,369	1,246,368	720,957	8,171,005	156

State in which coal was used	Coal produced in—						
	Pennsylvania	Tennessee	Virginia	Washington	West Virginia	Coal imported from England	Total[a]
1923							
Alabama							6,609,431
Colorado							702,369
Illinois	22,093				1,564,968		4,589,863
Indiana	568,280		108,701		3,986,169		7,143,914
Maryland	637,159				535,903		1,173,062
Massachusetts			225,166		496,712	75,915	797,793
Michigan	204,977				1,101,911		2,286,754
Minnesota	527,920		4,538		339,708		999,899
New Jersey			683,817		523,788		1,207,605
New York	2,201,959				188,818		2,607,866
Ohio	5,161,864				1,696,566		9,287,435
Pennsylvania	11,795,831				1,612,121		13,407,952
Tennessee		171,703					171,703
Washington				54,811			54,811
West Virginia	933,958				466,905		1,400,863
Kentucky, Missouri, Rhode Island, and Wisconsin	80,116		79,039		1,003,445	15,307	2,079,369
	22,134,157	171,703	1,101,261	54,811	13,517,014	91,222	[a]54,520,689

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[a] Difference between these totals and those shown in Table 2, etc., is due to change in stock, loss of weight in handling, and other factors.

TABLE 32.—*Coal used in the manufacture of by-product coke, 1923–24, by sources, in net tons*—Continued

State in which coal was used	Coal produced in—						
	Alabama	Colorado	Georgia	Illinois	Indiana	Kentucky	Ohio
1924							
Alabama	6,380,572	--------	--------	--------	--------	--------	--------
Colorado	--------	860,069	--------	--------	--------	--------	--------
Illinois	--------	--------	--------	481,464	--------	1,532,902	19,640
Indiana	--------	--------	--------	242,921	878	1,422,930	--------
Massachusetts	--------	--------	--------	--------	--------	2,769	--------
Michigan	--------	--------	--------	--------	--------	1,906,041	--------
Minnesota	--------	--------	--------	--------	--------	93,219	--------
New York	--------	--------	--------	--------	--------	382,441	--------
Ohio	--------	--------	--------	--------	--------	2,178,464	111,371
Tennessee	--------	--------	20,821	--------	--------	--------	--------
West Virginia	--------	--------	--------	--------	--------	38,954	--------
Kentucky, Missouri, Rhode Island, and Wisconsin	--------	--------	--------	--------	--------	436,788	--------
	6,380,572	860,069	20,821	724,385	878	7,994,508	131,011

State in which coal was used	Coal produced in—							
	Pennsylvania	Tennessee	Utah	Virginia	Washington	West Virginia	Miscellaneous	Total[a]
1924								
Alabama	--------	--------	--------	--------	--------	--------	--------	6,380,572
Colorado	--------	--------	--------	--------	--------	--------	--------	860,069
Illinois	100,394	--------	--------	--------	--------	1,146,366	--------	3,280,766
Indiana	261,656	--------	--------	--------	--------	3,899,929	--------	5,828,314
Maryland	1,103,984	--------	--------	--------	--------	--------	--------	1,103,984
Massachusetts	--------	--------	--------	224,963	--------	346,846	--------	574,578
Michigan	166,624	--------	--------	--------	--------	331,757	--------	2,404,422
Minnesota	312,506	--------	--------	--------	--------	338,842	--------	744,567
New Jersey	--------	--------	--------	553,464	--------	649,268	--------	1,202,732
New York	1,541,809	--------	--------	--------	--------	340,812	--------	2,265,062
Ohio	4,729,821	--------	--------	--------	--------	1,276,102	--------	8,295,758
Pennsylvania	12,104,298	--------	--------	--------	--------	451,270	--------	12,555,568
Tennessee	--------	60,090	--------	--------	--------	--------	22,403	103,314
Utah	--------	--------	190,035	--------	--------	--------	--------	190,035
Washington	--------	--------	--------	--------	70,968	--------	--------	70,968
West Virginia	1,338,541	--------	--------	--------	--------	107,457	--------	1,484,952
Kentucky, Missouri, Rhode Island, and Wisconsin	65,733	--------	--------	204,834	--------	809,645	1,668	1,518,668
	21,725,366	60,090	190,035	983,261	70,968	9,698,294	24,071	[a] 48,864,329

[a] Difference between these totals and those shown in Table 2, etc., is due to change in stock, loss of weight in handling, and other factors.

YIELD OF COKE PER TON OF COAL

TABLE 33.—*Percentage yield of coke from coal in by-product and beehive ovens in the United States, 1921–1924*

State	1921		1922		1923		1924	
	By-product	Beehive	By-product	Beehive	By-product	Beehive	By-product	Beehive
Alabama	69.1	59.6	68.3	60.1	68.4	57.9	68.8	60.4
Colorado	68.7	65.7	68.9	65.0	68.6	65.0	69.3	64.2
Georgia	----------	54.6	----------	54.6	----------	52.0	----------	56.1
Illinois	67.7	----------	68.9	----------	69.4	----------	69.3	----------
Indiana	71.2	----------	72.5	----------	70.6	----------	73.3	----------
Kentucky	71.9	61.6	72.6	56.9	74.5	54.5	75.1	54.0
Maryland	73.9	----------	73.8	----------	73.4	----------	73.4	----------
Massachusetts	73.5	----------	67.1	----------	69.4	----------	69.2	----------
Michigan	70.4	----------	72.3	----------	72.1	----------	73.5	----------
Minnesota	69.2	----------	67.2	----------	69.6	----------	69.1	----------
Missouri	70.8	----------	69.3	----------	73.9	----------	74.5	----------
New Jersey	69.5	----------	72.9	----------	74.3	----------	72.3	----------
New Mexico	----------	71.8	----------	62.0	----------	51.8	----------	61.0
New York	68.0	----------	67.7	----------	68.4	----------	70.7	----------
Ohio	67.8	62.3	68.9	65.0	68.1	65.0	67.9	65.0
Oklahoma	----------	----------	----------	----------	----------	52.1	----------	----------
Pennsylvania	67.4	66.4	69.0	65.6	68.5	65.3	67.1	65.4
Rhode Island	70.0	----------	70.0	----------	70.0	----------	70.4	----------
Tennessee	72.2	51.5	74.1	49.4	72.3	54.5	73.3	52.9
Utah	----------	57.3	----------	57.6	----------	57.8	51.2	59.4
Virginia	----------	63.5	----------	62.9	----------	62.4	----------	63.0
Washington	54.5	55.6	59.8	63.8	56.7	68.2	56.2	64.3
West Virginia	67.9	61.0	66.2	60.1	67.2	60.7	67.3	61.7
Wisconsin	66.5	----------	67.8	----------	68.8	----------	67.7	----------
Average	68.8	65.3	69.5	64.5	69.3	64.4	69.3	64.6

COKE BREEZE

TABLE 34.—*Coke breeze recovered at coke plants in the United States, 1923–24, by States*

State	Yield (per cent of coal)	Produced		Used for steam raising		Used for other purposes by producer		Sold		Put in stock (net tons)	Wasted (net tons)
		Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value		
1923											
By-product ovens											
Alabama	4.4	284,530	$641,049	153,217	$313,846	11,829	$24,047	36,101	$128,170	19,430	28,022
Colorado	4.4	28,999	(a)	22,765	(a)	7,082	(a)				
Illinois	5.5	250,778	587,193	162,240	384,369	2,518	4,407	44,329	107,755	9,113	
Indiana	6.2	439,891	1,208,659	191,170	504,161	49,236	117,371	80,201	255,983	66,773	
Maryland	6.6	76,915	(a)	7,451	(a)	20,970	(a)	4,574	(a)	43,920	
Massachusetts	6.2	49,377	(a)	23,617	(a)	1,317	(a)	25,880	(a)	9,132	
Michigan	4.7	107,603	278,675	49,749	127,219			31,341	84,436	23,766	2,436
Minnesota	6.0	60,320	151,310	50,680	100,067	11,086	35,475	16,523	44,804		
New Jersey	5.3	63,803	(a)	55,676	(a)			14,206	(a)	1,270	
New York	6.2	161,368	558,577	88,670	184,133	40	80	55,286	324,281	5,271	
Ohio	6.7	619,300	2,435,807	340,128	1,153,838	34,519	73,824	167,719	820,124	70,147	96
Pennsylvania	7.2	967,872	2,276,082	511,639	961,410	239,370	434,200	165,879	744,691	44,657	10,502
Tennessee	4.2	7,143	12,643					5,417	9,582	1,726	
Washington	10.0	5,457	5,457	5,452	5,452			5	18		
West Virginia	6.7	93,205	85,193	42,682	37,500	4,858	3,949	26,076	26,319	18,881	708
Kentucky, Missouri, Rhode Island, and Wisconsin	5.6	116,153	216,497	78,385	145,256	11,771	32,030	16,801	32,166	1,700	7,624
Undistributed			591,272		283,719		61,270		138,516		
	6.1	3,332,714	9,048,414	1,783,521	4,200,970	394,596	786,653	690,338	2,716,845	315,786	49,388
Beehive ovens											
Alabama	[b] 1.7	1,368	2,452	1,319	2,374					49	
Colorado	[b] 1.0	2,978	7,971					2,978	7,977		
Pennsylvania	[b] 3.3	195,373	477,766	61,351	97,412	16,547	45,695	30,568	110,195	1,041	85,242
Tennessee	[b] 1.8	4,596	8,758	2,672	5,294			350	950		1,574
Virginia	[b] .9	4,437	20,578					3,550	18,459		888
West Virginia	[b] .5	1,290	3,450					415	1,254		810
New Mexico, Ohio, Oklahoma, and Utah	[b] 2.2	19,299	42,783					19,299	42,783		
	[b] 2.8	229,341	563,758	65,342	105,080	16,547	45,695	57,160	181,618	1,090	[c] 88,514

1924											
By-product ovens											
Alabama	4.2	265,799	439,013	122,695	225,896	56,456	96,501	33,197	83,898		34,234
Colorado	3.7	27,926	(a)	20,724	(a)	7,138	(a)	64	(a)		
Illinois	4.9	167,544	376,397	121,462	271,456			65,435	145,170		
Indiana	5.4	313,387	876,609	300,441	846,849	47,225	98,761	25,770	102,832		
Maryland	6.2	68,570	(a)	45,553	(a)	26,041	(a)	11,372	(a)		
Massachusetts	6.7	38,491	(a)	37,117	(a)	1,097	(a)	4,175	(a)		
Michigan	5.4	129,573	335,609	77,860	182,369	6,697	26,464	49,747	130,914		
Minnesota	8.3	62,170	130,768	44,191	76,667	7,866	25,269	12,935	49,460		45
New Jersey	4.1	49,903	(a)	49,369	(a)			876	(a)		
New York	4.5	101,824	207,374	88,492	176,886	2,813	13,495	9,517	16,166		52
Ohio	6.7	565,018	1,090,979	384,967	601,280	13,734	25,953	178,444	500,568		4,418
Pennsylvania	7.4	929,970	1,693,862	721,621	1,311,791	112,251	187,656	82,813	226,697		32,768
Tennessee	3.7	3,786	5,318	2,765	2,765			1,021	2,553		
Utah	13.2	25,013	(a)					6,800	(a)		
Washington	8.8	6,278	6,278	6,278	6,278						
West Virginia	6.8	100,845	145,341	53,960	55,731	9,774	14,356	38,042	75,952		
Kentucky, Missouri, Rhode Island, and Wisconsin	6.0	94,713	174,316	72,787	127,256	9,333	25,882	15,829	25,421		
Undistributed			697,563		347,564		51,873		131,844		
	6.0	2,950,810	6,179,427	2,150,282	4,232,788	300,425	566,210	536,037	1,491,475		71,517
Beehive ovens											
Colorado	[b] 1.8	5,811	21,824	308	1,849	7	40	5,496	19,935		
Pennsylvania	[b] 7.6	351,913	1,235,051	65,918	82,454	1,095	2,069	13,330	28,630	4,693	147,766
Tennessee	[b] 2.0	2,570	9,601			1,535	7,566	185	335		
Virginia	[b] .9	3,740	14,778					2,830	11,629		910
West Virginia	[b] 1.2	640	2,214								640
New Mexico, Ohio, Utah, and Washington	[b] 1.8	10,456	15,386	13	91	92	644	10,349	14,582		
	[b] 6.1	375,130	1,298,854	66,239	84,394	2,729	10,319	32,190	75,111	4,693	[c] 149,316

[a] Included under "Undistributed."

[b] Yield computed by dividing the production of breeze at the few plants reporting by the quantity of coal charged at those plants.

[c] As reported; quantity produced but not used was undoubtedly greater. See Mineral Resources, 1922, pt. 2, pp. 726-727, 1925.

DISPOSAL, SALES, AND STOCKS

TABLE 35.—*By-product coke produced and sold or used by the producer in the United States, 1923–24*

[Exclusive of screenings and breeze]

State	Produced		Sold					
			Furnace				Foundry	
	Net tons	Value	To affiliated corporations		Merchant sales		Net tons	Value
			Net tons	Value	Net tons	Value		
1923								
Alabama	4, 385, 366	$18, 156, 491	103, 367	$593, 327	68, 283	$405, 146	279, 721	$2, 050, 208
Colorado	448, 243	(a)						
Illinois	3, 187, 168	30, 373, 638			67, 371	586, 550	180, 620	1, 680, 491
Indiana	5, 042, 614	46, 765, 264	56	491	660	7, 035	199, 832	2, 387, 066
Maryland	861, 668	(a)						
Massachusetts	554, 125	(a)					306, 328	(a)
Michigan	1, 648, 773	14, 389, 742			264, 293	2, 103, 772	186, 918	2, 072, 921
Minnesota	695, 824	5, 104, 330					45, 768	623, 898
New Jersey	897, 569	(a)			17, 415	(a)	185, 252	(a)
New York	1, 783, 948	12, 808, 335	645, 087	4, 865, 181	233, 153	1, 452, 462		
Ohio	6, 323, 810	40, 712, 282	539, 423	3, 589, 141	350, 347	1, 737, 330	5, 526	44, 132
Pennsylvania	9, 185, 747	43, 520, 249	1, 025, 479	7, 258, 914	198, 674	1, 581, 350	800	4, 844
Tennessee	124, 160	825, 542			23, 126	146, 647	68, 563	475, 018
Washington	31, 081	237, 148						
West Virginia	940, 866	5, 345, 432			86, 349	526, 917		
Kentucky, Missouri, Rhode Island, and Wisconsin	1, 486, 702	15, 755, 203			150, 867	1, 148, 261	438, 627	5, 195, 670
Undistributed		23, 597, 662				151, 585		5, 461, 094
	37, 597, 664	257, 591, 318	2, 313, 412	16, 307, 054	1, 460, 538	9, 847, 055	1, 897, 955	19, 995, 342

State	Sold—Continued						Used by producer in blast furnace, etc.	
	Domestic use		Industrial and other use		Total			
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
1923								
Alabama	97, 342	$663, 854	95, 206	$423, 157	643, 919	$4, 135, 692	3, 991, 309	$14, 904, 844
Colorado			34, 772	([a])	34, 772	([a])	413, 583	([a])
Illinois	351, 422	3, 097, 896	323, 481	3, 704, 302	922, 894	9, 069, 239	1, 907, 479	17, 840, 000
Indiana	164, 613	1, 025, 687	104, 681	1, 003, 810	469, 842	4, 424, 089	4, 511, 227	41, 793, 311
Maryland			126, 139	([a])	126, 139	([a])	738, 538	([a])
Massachusetts	218, 912	([a])			525, 240	([a])	5, 789	([a])
Michigan	481, 150	4, 383, 671	81, 398	768, 262	1, 013, 759	9, 328, 626	534, 775	4, 167, 385
Minnesota	193, 326	2, 505, 009	898	10, 843	239, 992	3, 139, 750	440, 357	4, 498, 330
New Jersey	206, 936	([a])	398, 886	([a])	808, 489	([a])	56, 492	([a])
New York	102, 400	787, 771	60, 920	486, 316	1, 041, 560	7, 591, 730	733, 839	5, 177, 504
Ohio	45, 267	286, 104	48, 450	356, 948	989, 013	6, 013, 655	5, 268, 274	34, 210, 892
Pennsylvania	154, 642	982, 708	37, 147	312, 499	1, 416, 742	10, 140, 315	7, 723, 344	33, 132, 175
Tennessee	21, 343	150, 372			113, 032	772, 037		
Washington	2, 443	20, 766			2, 443	20, 766	29, 687	207, 809
West Virginia	139, 448	902, 228			225, 797	1, 429, 145	678, 357	3, 673, 372
Kentucky, Missouri, Rhode Island, and Wisconsin	458, 274	4, 727, 627	326, 248	3, 293, 345	1, 374, 016	14, 364, 903	22, 347	212, 322
Undistributed		4, 338, 314		4, 486, 170		14, 437, 163		8, 561, 656
	2, 637, 518	23, 872, 007	1, 638, 226	14, 845, 652	9, 947, 649	84, 867, 110	27, 055, 397	168, 379, 600

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[a] Included under "Undistributed."

TABLE 35.—*By-product coke produced and sold or used by the producer in the United States, 1923–24*—Continued

[Exclusive of screenings and breeze]

State	Produced		Sold					
			Furnace				Foundry	
			To affiliated corporations		Merchant sales			
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
1924								
Alabama	4,386,372	$16,563,223	44,964	$230,432	13,784	$64,291	295,932	$1,535,410
Colorado	523,405	(a)	------	------	------	------	------	------
Illinois	2,355,474	20,187,519	66,482	477,744	70,415	531,829	163,208	1,661,729
Indiana	4,272,435	30,394,497	2,543	20,310	------	------	181,677	1,735,679
Maryland	810,118	(a)	------	------	------	------	------	------
Massachusetts	397,640	(a)	------	------	------	------	207,129	(a)
Michigan	1,770,547	11,914,028	78,295	252,437	297,984	1,738,147	167,089	1,519,169
Minnesota	514,764	4,903,891	------	------	------	------	38,922	437,027
New Jersey	869,120	(a)	156,458	(a)	2,483	(a)	65,646	(a)
New York	1,600,669	11,108,944	554,211	3,662,176	236,304	1,772,399	29,441	236,446
Ohio	5,723,074	31,008,209	514,127	2,786,162	586,110	3,048,142	8,261	56,383
Pennsylvania	8,426,155	34,674,512	917,976	4,807,755	276,073	1,355,752	9,634	55.219
Tennessee	75,720	376,328	------	------	27,187	117,876	32,504	199,820
Utah	97,350	(a)	------	------	------	------	------	------
Washington	39,903	283,710	------	------	------	------	2,832	24,072
West Virginia	998,914	4,402,186	------	------	------	------	24,160	107,282
Kentucky, Missouri, Rhode Island, and Wisconsin	1,121,908	9,387,943	------	------	80,643	499,227	327,414	3,171,976
Undistributed	------	20,485,019	------	1,258,271	------	21,858	------	2,685,122
	33,983,568	195,690,009	2,335,056	13,495,287	1,590,983	9,149,521	1,553,849	13,425,334

State	Sold—Continued						Used by producer in blast furnace, etc.	
	Domestic use		Industrial and other use		Total			
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
1924								
Alabama	57, 663	$255, 864	93, 787	$415, 493	506, 130	$2, 501, 490	3, 888, 760	$14, 137, 294
Colorado	16, 559	(a)			16, 559	(a)	505, 846	(a)
Illinois	329, 789	2, 552. 829	333, 513	3, 535, 514	963, 407	8, 759, 645	1, 327, 820	10, 799, 086
Indiana	276, 013	1, 533, 570	9, 776	64, 134	470, 009	3, 353, 693	3, 831, 406	26, 878, 239
Maryland			113, 836	(a)	113, 836	(a)	693, 588	(a)
Massachusetts	203, 763	(a)			410, 892	(a)	5, 446	(a)
Michigan	789, 126	4, 998, 320	12, 697	109, 625	1, 345, 191	8, 617, 698	535, 296	3, 817, 866
Minnesota	181, 557	1, 735, 481	3, 029	28, 938	223, 508	2, 201, 446	199, 253	1, 695, 269
New Jersey	158, 804	(a)	427, 104	(a)	810, 495	(a)	51, 850	(a)
New York	218, 319	1, 510, 954	2, 993	11, 897	1, 041, 268	7, 193, 872	556, 283	3, 888, 027
Ohio	28, 709	135, 236	78, 287	449, 133	1, 215, 494	6, 475, 056	4, 538, 383	24, 724, 264
Pennsylvania	20, 496	79, 006	58, 179	331, 487	1, 282, 358	6, 629, 219	7, 145, 581	28, 046, 102
Tennessee	22, 868	92, 950			82, 559	410, 646		
Utah	318	(a)			318	(a)	93, 704	(a)
Washington					2, 832	24, 072	34, 815	243, 705
West Virginia	119, 892	423, 913	151, 747	559, 758	295, 799	1, 090, 953	590, 428	2, 607, 708
Kentucky, Missouri, Rhode Island, and Wisconsin	388, 895	3, 195, 385	271, 227	2, 105, 257	1, 068, 179	8. 971, 845	25, 474	205, 634
Undistributed		3, 549, 909		4, 243, 462		11, 758, 622		8, 795, 193
	2, 812, 771	20, 063, 417	1, 556, 175	11, 854, 698	9, 848, 834	67, 988, 257	24, 023, 933	125, 838, 387

[a] Included under "Undistributed."

TABLE 36.—*Beehive coke produced and sold or used by the producer in the United States, 1923–24*

[Exclusive of screenings and breeze]

State	Produced		Sold					
			Furnace				Foundry	
			To affiliated corporations		Merchant sales			
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
1923								
Alabama	268,709	$1,660,903	------	------	3,536	$22,189	129,384	$794,056
Colorado	199,580	(a)	90,122	(a)	49,644	(a)	5,261	(a)
Georgia	12,556	126,690	------	------	------	------	12,112	122,229
Kentucky	125,595	874,752	112,863	(a)	12,704	(a)	------	------
Ohio	149,796	(a)	------	------	------	------	------	------
Pennsylvania	16,438,539	94,923,942	7,562,300	$43,015,059	5,457,530	32,326,516	1,114,315	7,719,015
Tennessee	180,351	1,244,011	------	------	19,723	149,343	8,762	64,850
Utah	232,941	1,977,669	------	------	226,488	1,921,806	2,137	18,673
Virginia	774,887	5,086,612	------	------	252,041	1,608,277	186,938	1,371,858
Washington	37,987	347,364	23,559	212,031	------	------	14,428	135,333
West Virginia	821,909	5,758,284	54,060	316,880	364,605	2,303,563	225,534	1,966,031
New Mexico and Oklahoma	137,020	1,157,400	80,879	688,280	51,500	498,872	3,893	23,360
Undistributed	------	2,747,953	------	1,524,743	------	496,127	------	43,791
	19,379,870	115,905,580	7,923,783	45,756,993	6,437,771	39,326,693	1,702,764	12,259,196

State	Sold—Continued						Used by producer in blast furnace, etc.	
	Domestic use		Industrial and other use		Total			
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
1923								
Alabama			42,985	$294,637	175,905	$1,110,882	111,414	$661,328
Colorado			41,321	(a)	186,348	(a)	12,576	(a)
Georgia					12,112	122,229		
Kentucky					125,567	(a)		
Ohio							151,765	(a)
Pennsylvania	94,423	$452,928	279,623	1,605,761	14,508,191	85,119,279	1,932,717	9,764,959
Tennessee			14,378	61,758	42,863	275,951	136,432	961,239
Utah			4,470	37,881	233,095	1,978,360		
Virginia			170,641	1,082,323	609,620	4,062,458	159,696	990,477
Washington					37,987	347,364		
West Virginia	784	3,163	91,393	649,148	736,376	5,238,785	78,907	473,442
New Mexico and Oklahoma	689	5,880	851	7,196	137,812	1,223,588		
Undistributed				373,532		2,438,193		1,194,201
	95,896	461,971	645,662	4,112,236	16,805,876	101,917,089	2,583,507	14,045,646

[a] Included under "Undistributed."

TABLE 36.—*Beehive coke produced and sold or used by the producer in the United States, 1923–24*—Continued

[Exclusive of screenings and breeze]

State	Produced		Sold					
			Furnace				Foundry	
			To affiliated corporations		Merchant sales			
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
1924								
Alabama	154,686	$840,843	19,316	$108,503			33,437	$189,698
Colorado	212,115	(a)	136,581	(a)	29,286	(a)	17,640	(a)
Georgia	8,081	71,355					8,532	75,299
Kentucky	79,248	(a)			13,304	(a)		
New Mexico	83,070	(a)	71,685	(a)				
Ohio	109,625	(a)						
Pennsylvania	8,501,282	37,893,584	3,302,638	15,801,518	2,890,839	$10,813,848	992,679	5,159,096
Tennessee	131,755	635,736			6,926	50,445	758	6,456
Utah	159,744	1,310,929			149,635	1,233,473	10,109	77,456
Virginia	485,064	2,343,081	25,438	132,214	148,972	710,430	169,679	879,304
Washington	31,712	289,934					18,997	175,473
West Virginia	329,655	1,646,452	26,346	129,210	118,471	404,948	112,121	827,824
Undistributed		3,319,638		1,535,051		293,994		152,537
	10,286,037	48,351,552	3,582,004	17,706,496	3,357,433	13,507,138	1,363,952	7,543,143

State	Sold—Continued						Used by producer in blast furnace, etc.	
	Domestic use		Industrial and other use		Total			
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
1924								
Alabama			38,145	$187,970	90,898	$486,171	62,796	$349,188
Colorado	10,297	(a)	2,723	(a)	196,527	(a)	16,062	(a)
Georgia					8,532	75,299		
Kentucky					13,304	(a)	65,944	(a)
New Mexico	1,082	(a)	10,911	(a)	83,678	(a)		
Ohio	77	(a)			77	(a)	111,740	(a)
Pennsylvania	127,734	$403,573	82,716	282,227	7,396,606	32,460.262	1,093,896	5,257,346
Tennessee			14,558	59,753	22,242	116,654	106,759	507,105
Utah					159,744	1,310,929		
Virginia			52,182	203,951	396,271	1,925,899	91,530	428,271
Washington					18,997	175,473	12,605	113,445
West Virginia	696	2,989	58,811	215,759	316,445	1,580,730	12,705	62,926
Undistributed		102,771		102,589		2,186,942		1,154,075
	139,886	509,333	260,046	1,052,249	8,703,321	40,318,359	1,574,037	7,872,356

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[a] Included under "Undistributed."

TABLE 37.—*Stocks of unsold coke at 21 by-product coke plants supplying gas for city use, 1922–1924, in net tons*

1922		**1923**	
Jan. 1	1,017,000	June 1	202,000
Mar. 1	987,000	July 1	308,000
Oct. 1	250,000	Aug. 1	429,000
Nov. 1	228,000	Sept. 1	501,000
1923		Oct. 1	476,000
Jan. 1	212,000	**1924**	
Feb. 1	146,000	Jan. 1	772,000
Mar. 1	92,000	Sept. 1	1,114,000

TABLE 38.—*Stocks of furnace and foundry coke and of breeze at the end of 1923 and 1924, by States, in net tons*

State	Furnace	Foundry	Breeze
1923			
By-product plants			
Alabama	268,340		79,220
Colorado	1,611	100	
Illinois	94,565	132,281	29,833
Indiana	13,830	36,490	81,696
Maryland	3,024		43,920
Massachusetts		20,364	9,715
Michigan	1,182	31,090	24,369
Minnesota	121,464		
New Jersey	15,695	19,843	1,230
New York	24,040	1,271	27,716
Ohio	80,027	21,947	77,129
Pennsylvania	74,425	72	59,830
Tennessee	11,302	120	1,726
Washington		4,537	
West Virginia	29,502	8,868	1,194
Kentucky, Missouri, Rhode Island, and Wisconsin	9,368	107,413	27,177
	748,375	384,396	464,755
Beehive plants			
Alabama	20,018	1,263	49
Colorado	1,537		
Georgia		520	
Kentucky	1,457		
Ohio	2,969		
Pennsylvania	37,916	3,692	17,758
Tennessee	850	989	50
Utah	225		
Virginia	9,018	575	
Washington			
West Virginia	5,735	380	
New Mexico and Oklahoma	1,621	201	
	81,346	7,620	17,857

TABLE 38.—*Stocks of furnace and foundry coke and of breeze at the end of 1923 and 1924, by States, in net tons*—Continued

State	Furnace	Foundry	Breeze
1924			
By-product plants			
Alabama	274, 397	520	58, 838
Colorado	2, 711		
Illinois	14, 732	417, 287	17, 083
Indiana	21, 552	31, 513	15, 562
Maryland	5, 718		
Massachusetts		11, 381	5, 234
Michigan	822	54, 899	22, 062
Minnesota	30, 698	180, 892	4, 153
New Jersey		42, 838	1, 233
New York	9, 603	25, 016	30, 084
Ohio	82, 363	18, 310	63, 380
Pennsylvania	68, 106	5, 192	39, 827
Tennessee	4, 089	494	606
Utah	3, 328		18, 234
Washington	10, 429		
West Virginia	17, 359		508
Kentucky, Missouri, Rhode Island, and Wisconsin	9, 173	142, 838	3, 816
	555, 080	931, 180	280, 620
Beehive plants			
Alabama	57	1, 845	
Colorado	487	790	
Georgia		69	
Kentucky			
New Mexico	805		
Ohio	3, 855		
Pennsylvania	37, 379	7, 328	4, 693
Tennessee	5, 877	400	
Utah	296		
Virginia	4, 628	1, 725	
Washington		110	
West Virginia	8, 530	240	
	61, 914	12, 507	4, 693

TABLE 39.—*Coke consumed in the manufacture of pig iron, 1913–1924*

[From annual report of the American Iron and Steel Institute]

Year	Coke consumed		Pig iron produced (gross tons)[a]
	Net tons	Pounds per gross ton of pig iron produced	
1913	37, 192, 287	2, 433. 3	30, 326, 130
1914	27, 070, 856	2, 354. 4	22, 976, 856
1915	33, 224, 328	2, 252. 0	29, 535, 308
1916	44, 431, 905	2, 285. 3	38, 844, 598
1917	44, 493, 316	2, 339. 7	37, 863, 643
1918	45, 703, 594	2, 375. 2	38, 422, 175
1919	35, 250, 943	2, 310. 2	30, 549, 930
1920	41, 976, 171	2, 305. 6	36, 300, 024
1921	18, 162, 147	2, 200. 6	16, 579, 653
1922	29, 213, 893	2, 176. 3	26, 995, 173
1923	44, 761, 526	2, 243. 3	40, 097, 239
1924	34, 303, 060	2, 212. 0	31, 193, 080

[a] Excludes pig iron made with anthracite and charcoal but includes small quantities made with electricity and bituminous coal.

VALUE AND PRICE

TABLE 40.—*Value of coke produced in the United States, 1923–24*

[Exclusive of screenings and breeze]

State	1923	1924	Decrease ,1924			
			Total	Percentage		
				Total	By-product	Beehive
Alabama	$19,817,394	$17,404,066	$2,413,328	12.2	8.8	49.4
Colorado	(a)	(a)	(a)	(a)	(a)	(a)
Georgia	126,690	71,355	55,335	43.7	----------	43.7
Illinois	30,373,638	20,187,519	10,186,119	33.5	33.5	----------
Indiana	46,765,264	30,394,497	16,370,767	35.0	35.0	----------
Kentucky	(a)	(a)	(a)	(a)	(a)	(a)
Maryland	(a)	(a)	(a)	(a)	(a)	----------
Massachusetts	(a)	(a)	(a)	(a)	(a)	----------
Michigan	14,389,742	11,914,028	2,475,714	17.2	17.2	----------
Minnesota	5,104,330	4,903,891	200,439	3.9	3.9	----------
Missouri	(a)	(a)	(a)	(a)	(a)	----------
New Jersey	(a)	(a)	(a)	(a)	(a)	----------
New Mexico	(a)	(a)	(a)	(a)	----------	(a)
New York	12,808,335	11,108,944	1,699,391	13.3	13.3	----------
Ohio	(a)	(a)	(a)	(a)	23.8	(a)
Oklahoma	(a)	----------	(a)	(a)	----------	(a)
Pennsylvania	138,444,191	72,568,096	65,876,095	47.6	20.3	60.1
Rhode Island	(a)	(a)	(a)	(a)	(a)	----------
Tennessee	2,069,553	1,012,064	1,057,489	51.1	54.4	48.9
Utah	1,977,669	(a)	(a)	(a)	(a)	33.7
Virginia	5,086,612	2,343,081	2,743,531	53.9	----------	53.9
Washington	584,512	573,644	10,868	1.9	[b] 19.6	16.5
West Virginia	11,103,716	6,048,638	5,055,078	45.5	17.6	71.4
Wisconsin	(a)	(a)	(a)	(a)	(a)	----------
Combined States	84,845,252	65,511,738	21,311,183	24.5	24.1	26.2
	373,496,898	244,041,561	129,455,337	34.7	24.0	58.3

[a] Included under "Combined States."
[b] Increase.

TABLE 41.—*Average value per net ton of coke exported from the United States, 1900–1924*

[Computed from records of Bureau of Foreign and Domestic Commerce]

Year	Average value	Year	Average value
1900	$3.22	1913	$3.35
1901	3.63	1914	3.37
1902	4.06	1915	3.45
1903	4.49	1916	3.58
1904	3.95	1917	6.06
1905	3.34	1918	7.03
1906	3.21	1919	7.15
1907	3.27	1920	10.87
1908	3.10	1921	9.00
1909	3.22	1922	8.44
1910	3.10	1923	9.61
1911	3.14	1924	7.47
1912	3.29		

TABLE 42.—*Average receipts per ton for coke sold in the United States, 1923–24*

State	By-product					Beehive				
	Furnace		Foundry	Domestic	Industrial, etc.	Furnace		Foundry	Domestic	Industrial, etc.
	To affiliated corporations	Merchant sales				To affiliated corporations	Merchant sales			
1923										
Alabama	$5.74	$5.93	$7.33	$6.82	$4.44		$6.28	$6.14		$6.85
Colorado					(a)	$8.15	8.29	8.32		(a)
Georgia								10.09		
Illinois		8.70	9.30	8.82	11.45					
Indiana	8.77	10.66	11.94	6.23	9.59					
Kentucky		(a)	(a)	(a)		7.00	6.65			
Maryland					(a)					
Massachusetts			(a)	(a)						
Michigan		7.96	11.09	9.11	9.44					
Minnesota			13.63	12.96	12.07					
Missouri			(a)	(a)	(a)					
New Jersey		(a)	(a)	(a)	(a)					
New Mexico						(a)	(a)		(a)	(a)
New York	7.54	6.23		7.69	7.98					
Ohio	6.65	4.96	7.99	7.98	7.37					
Oklahoma								(a)	(a)	(a)
Pennsylvania	7.08	7.96	6.05	6.35	8.41	5.69	5.92	6.93	$4.80	5.74
Rhode Island			(a)	(a)						
Tennessee		6.34	6.93	7.04			7.57	7.40		4.30
Utah							8.49	8.74		8.48
Virginia							6.38	7.34		6.34
Washington				(a)		9.00		9.38		
West Virginia		6.10		6.47		5.86	6.32	8.72	4.03	7.10
Wisconsin			(a)	(a)	(a)					
Combined States		7.72	11.46	10.25	8.78	8.51	9.69	6.00	8.53	9.03
	7.05	6.74	10.54	9.05	9.06	5.77	6.11	7.20	4.82	6.37
1924										
Alabama	5.12	4.66	5.19	4.44	4.43	5.62		5.67		4.93
Colorado				(a)		(a)	(a)	(a)	(a)	(a)
Georgia								8.83		
Illinois	7.19	7.55	10.18	7.74	10.60					
Indiana	7.99		9.55	5.56	6.56					
Kentucky		(a)	(a)	(a)			(a)			
Maryland					(a)					
Massachusetts			(a)	(a)						
Michigan	3.22	5.83	9.09	6.33	8.63					
Minnesota			11.23	9.56	9.55					
Missouri			(a)	(a)	(a)					
New Jersey	(a)	(a)	(a)	(a)	(a)					
New Mexico						(a)			(a)	(a)
New York	6.61	7.50	8.03	6.92	3.97					
Ohio	5.42	5.20	6.83	4.71	5.74				(a)	
Pennsylvania	5.24	4.91	5.73	3.85	5.70	4.78	3.74	5.20	3.16	3.41
Rhode Island			(a)	(a)						
Tennessee		4.34	6.15	4.06			7.28	8.52		4.10
Utah				(a)			8.24	7.66		
Virginia						5.20	4.77	5.18		3.91
Washington			8.50					9.24		
West Virginia			4.44	3.54	3.69	4.90	3.42	7.38	4.29	3.67
Wisconsin			(a)	(a)	(a)					
Combined States	8.04	6.27	9.76	8.78	7.82	7.37	6.90	8.65	8.97	7.52
	5.78	5.75	8.64	7.13	7.62	4.94	4.02	5.53	3.64	4.05

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[a] Included under "Combined States."

TABLE 43.—*Average value per ton of all coke produced, 1913–1924, and average receipts per ton for coke sold, 1918–1924*

Year	Value per ton produced [a]			Receipts per ton sold		
	By-product	Beehive	Total	By-product	Beehive	Total
1913	$3.83	$2.39	$2.78	(b)	(b)	(b)
1914	3.39	2.15	2.56	(b)	(b)	(b)
1915	3.45	2.07	2.54	(b)	(b)	(b)
1916	3.95	2.69	3.13	(b)	(b)	(b)
1917	6.18	4.81	5.36	(b)	(b)	(b)
1918	7.42	6.21	6.77	$7.88	$6.08	$6.52
1919	6.37	5.15	5.85	6.58	5.05	5.60
1920	10.15	7.94	9.27	10.77	7.43	8.50
1921	5.95	5.45	5.84	7.72	5.41	6.56
1922	6.59	5.84	6.42	8.45	5.79	7.19
1923	6.85	5.98	6.56	8.53	6.06	6.98
1924	5.76	4.70	5.51	6.90	4.63	5.84

[a] Includes operators' statements of the value of coke consumed by them in associated enterprises but not sold, except that in 1918 and 1920 the value of such coke was estimated for each State at the average value for that State of the part of the product reported sold.

[b] Data not available.

TABLE 44.—*Average monthly prices per net ton at ovens of spot or prompt Connellsville furnace and foundry coke, 1904–1924* [a]

Month	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924
Furnace																					
January	$1.60	$2.46	$2.62	$3.53	$1.92	$1.59	$2.55	$1.40	$1.82	$3.88	$1.85	$1.50	$2.94	$9.50	$6.00	$5.65	$6.00	$5.06	$2.75	$8.05	$3.94
February	1.52	2.56	2.14	3.50	1.86	1.59	2.12	1.45	1.78	2.52	1.85	1.50	3.38	9.62	6.00	4.44	6.00	4.50	3.04	7.13	4.08
March	1.65	2.43	2.24	3.02	1.72	1.60	2.00	1.55	2.12	2.40	1.90	1.50	3.47	9.60	6.00	4.06	6.00	4.35	3.25	7.25	4.08
April	1.60	2.07	2.45	2.72	1.57	1.60	1.77	1.59	2.39	2.15	1.86	1.50	2.41	7.38	6.00	3.65	9.60	3.50	4.48	6.31	3.75
May	1.50	1.87	2.46	2.16	1.50	1.57	1.66	1.50	2.28	2.13	1.77	1.50	2.30	7.80	6.00	3.69	12.00	3.25	6.00	5.15	3.25
June	1.45	1.82	2.32	1.89	1.55	1.52	1.65	1.42	2.02	2.11	1.75	1.56	2.49	11.25	6.00	4.00	15.00	3.00	6.75	4.75	3.19
July	1.45	1.81	2.51	2.40	1.57	1.58	1.59	1.44	2.21	2.45	1.75	1.64	2.75	12.75	6.00	4.07	17.20	2.81	10.75	4.55	3.00
August	1.45	1.80	2.76	2.62	1.50	1.66	1.57	1.46	2.21	2.50	1.70	1.50	2.80	13.60	6.00	4.31	17.75	2.75	12.80	4.56	3.00
September	1.45	2.10	2.85	2.82	1.50	2.39	1.60	1.50	2.37	2.29	1.65	1.61	2.94	11.12	6.00	4.56	16.70	3.15	11.13	4.50	3.00
October	1.47	2.61	2.84	2.85	1.53	2.76	1.59	1.50	3.41	2.98	1.60	2.03	4.88	6.00	6.00	4.52	15.12	3.28	9.60	3.85	3.00
November	2.04	2.95	3.13	2.41	1.72	2.74	1.50	1.52	3.94	1.82	1.52	2.28	6.90	6.00	6.00	5.87	8.26	3.03	7.19	3.81	3.04
December	2.12	2.79	3.52	2.06	1.82	2.67	1.44	1.60	4.00	1.75	1.50	2.64	8.38	6.00	6.00	6.12	6.20	2.75	7.00	4.00	3.57
Average	1.61	2.27	2.65	2.67	1.65	1.94	1.75	1.49	2.55	2.42	1.73	1.73	3.80	9.22	6.00	4.58	11.32	3.45	7.06	5.33	3.41
Foundry																					
January	2.18	2.38	3.42	4.25	2.45	2.00	2.90	1.90	1.97	4.40	2.50	2.00	3.50	9.75	7.00	6.25	7.00	6.38	3.75	8.70	4.75
February	2.10	2.68	2.65	4.00	2.39	1.95	2.70	2.10	2.09	3.25	2.50	2.00	3.50	11.00	7.00	5.00	7.00	5.63	4.00	8.25	4.88
March	2.25	2.75	2.78	3.65	2.25	1.95	2.60	2.05	2.56	3.00	2.45	2.00	3.75	11.60	7.00	4.94	7.00	5.45	4.25	8.38	4.88
April	2.15	2.70	2.95	3.31	2.22	1.86	2.45	2.00	2.69	3.00	2.40	2.00	3.56	9.13	7.00	4.30	10.20	4.75	5.06	7.56	4.75
May	2.00	2.55	2.81	3.00	2.03	1.85	2.20	1.81	2.58	2.85	2.40	2.00	3.25	8.90	7.00	4.31	13.00	4.50	6.30	6.15	4.69
June	1.90	2.40	2.65	3.00	2.00	1.80	2.17	1.76	2.40	2.80	2.32	2.00	3.25	11.72	7.00	4.56	15.75	4.45	7.25	5.56	4.38
July	1.80	2.35	2.79	3.00	2.00	2.00	2.15	1.82	2.40	2.70	2.22	2.05	3.25	13.25	7.00	5.00	17.80	4.06	11.00	5.35	4.10
August	1.75	2.25	3.00	3.08	1.92	1.95	2.15	1.85	2.40	2.90	2.25	2.00	3.30	13.20	7.00	5.25	18.88	3.75	13.90	5.38	4.00
September	1.85	2.50	3.19	3.20	1.90	2.55	2.12	1.85	2.54	2.90	2.10	2.07	3.31	11.75	7.00	5.80	17.70	4.15	12.50	5.50	4.00
October	2.00	3.00	3.31	3.25	2.10	2.90	2.10	1.81	3.65	2.81	2.00	2.35	3.88	6.00	7.00	6.25	16.38	4.38	11.70	4.80	4.00
November	2.25	3.50	4.00	2.75	2.20	3.25	2.05	1.85	4.25	2.60	1.92	2.88	7.10	7.00	7.00	7.00	9.50	4.19	8.38	4.81	4.06
December	2.35	3.50	4.12	2.50	2.25	3.20	1.97	1.90	4.50	2.50	1.90	2.95	8.63	7.00	7.00	7.00	7.00	3.81	7.88	4.81	4.44
Average	2.05	2.71	3.14	3.25	2.14	2.27	2.30	1.89	2.84	2.98	2.25	2.19	4.19	10.03	7.00	5.47	12.27	4.63	8.00	6.27	4.41

[a] Iron Age, Jan. 1, 1925, p. 75.

EXPORTS AND IMPORTS[3]

TABLE 45.—*Coke exported from the United States, 1909–1924*

Year	Net tons	Value	Year	Net tons	Value
1909	1, 002. 916	$3. 232. 673	1917	1, 409, 320	$8, 543, 746
1910	984. 618	3. 053, 293	1918	1, 687, 824	11, 861. 408
1911	1, 023. 727	3, 215, 990	1919	716, 956	5, 128, 119
1912	912, 576	3, 002, 742	1920	919, 802	9, 993, 665
1913	987, 395	3, 309, 930	1921	306, 755	2, 760, 939
1914	663, 585	2, 233. 686	1922	511, 541	4, 319, 538
1915	895, 509	3, 092. 498	1923	1. 237, 342	11, 889, 897
1916	1, 174, 645	4, 202, 236	1924	659, 350	4, 926, 478

TABLE 46.—*Coke exported from the United States, 1922–1924, by customs districts*

District	1922		1923		1924	
	Net tons	Value	Net tons	Value	Net tons	Value
Arizona	25, 873	$211, 436	66, 363	$552, 698	5, 182	$44, 092
Buffalo	206, 995	1, 519, 685	400, 597	3, 536, 828	212, 930	1, 453, 105
Dakota	28, 344	282. 050	25, 339	283, 804	42, 731	345, 668
Duluth-Superior	3, 359	33, 288	2, 894	33. 570	5, 798	50, 137
El Paso	4, 135	40, 415	10. 637	128, 442	188	2, 242
Florida	3, 328	40, 190	7, 730	112, 985	5, 952	56, 910
Galveston	48	995	------	------	------	------
Georgia	782	9, 500	------	------	577	11, 845
Los Angeles	------	------	73	1, 571	7	128
Maine and New Hampshire	2. 762	25, 342	4, 633	51, 801	3, 221	24, 151
Maryland	15, 943	95, 310	190, 502	1, 893, 238	35, 842	219, 750
Massachusetts	------	------	28	236	------	------
Michigan	145. 013	1, 310, 144	193, 972	1, 918, 854	180, 626	1, 265, 672
Mobile	10, 408	70, 967	8. 865	113, 816	3, 048	52, 536
New Orleans	11, 185	155, 152	13, 569	171, 709	14, 137	195, 658
New York	7, 184	100, 332	14, 567	222, 348	18, 329	257, 294
Ohio	3. 760	35, 971	65, 619	387, 820	85, 407	521, 465
Philadelphia	16, 215	145, 658	152, 930	1, 769, 580	6, 872	99, 066
Porto Rico	24	438	20	324	76	769
Rochester	274	2, 534	1, 770	11, 450	214	1, 774
Sabine	27	333	6, 713	48, 332	17, 140	132, 993
St. Lawrence	10, 078	108, 061	37, 746	381, 929	7, 994	74, 901
San Antonio	3, 308	14, 661	3, 782	26, 787	1, 346	10, 126
San Diego	1	30	------	------	------	------
San Francisco	157	3, 973	111	2, 569	73	1, 825
South Carolina	714	2, 898	------	------	149	1, 201
Vermont	9, 042	89, 674	15, 698	162, 632	9, 458	77, 929
Virginia	2, 272	17, 255	13, 162	76, 164	898	10, 931
Washington	310	3, 246	22	410	1, 155	14, 310
	511, 541	4, 319, 538	1, 237, 342	11, 889, 897	659, 350	4, 926, 478

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[3] Figures of exports and imports compiled by J. A. Dorsey, of the Bureau of Mines, from records of the Bureau of Foreign and Domestic Commerce.

TABLE 47.—*Coke exported from the United States, 1922–1924, by countries of destination*

Destination	1922		1923		1924	
	Net tons	Value	Net tons	Value	Net tons	Value
Argentina	------	------	110	$1,250	8	$177
Belgium	224	$2,285	101,529	1,083,370	------	------
Bermuda	3	47	1	20	1	13
Brazil	4	62	6	92	35	441
British Honduras	7	122	4	71	------	------
Canada	410,828	3,416,769	748,219	6,768,462	549,452	3,828,462
Chile	11,975	75,126	41,548	297,444	32,454	198,812
Colombia	105	2,578	57	1,250	91	1,906
Costa Rica	67	1,446	110	1,961	52	923
Cuba	5,387	52,642	7,073	86,378	7,586	70,086
Denmark	------	------	24	451	------	------
Dominican Republic	73	1,326	127	2,621	240	3,600
Ecuador	34	803	90	2,186	93	1,813
England	631	6,500	2,955	44,370	739	12,131
France	8,641	112,698	143,828	1,604,131	17,303	257,122
French Oceania	7	132	2	44	13	300
Germany	5,459	58,682	60,141	749,058	9,783	117,704
Guatemala	34	541	96	1,875	91	1,639
Haiti	------	------	11	200	4	112
Honduras	36	647	122	2,139	90	1,163
Ireland	------	------	22	208	------	------
Italy	4,754	46,921	27,866	260,694	12,003	108,212
Jamaica	1,195	8,336	7	185	------	------
Mexico	34,390	283,565	81,688	724,396	7,750	67,101
Netherlands	9,500	124,841	8,103	108,217	7,805	120,686
Newfoundland and Labrador	------	------	36	498	157	1,527
Nicaragua	58	1,123	22	539	44	773
Norway	1,313	12,772	9,785	102,771	6,981	74,667
Other British West Indies	11	240	102	1,335	56	531
Panama	186	3,933	179	4,588	390	5,855
Paraguay	34	713	------	------	28	504
Peru	11,382	56,694	122	1,333	3,556	22,386
Philippine Islands	------	------	------	------	25	361
Salvador	60	1,440	50	1,155	49	1,126
Scotland	4,552	39,560	1,075	15,800	------	------
Spain	------	------	1,122	10,220	------	------
Switzerland	515	5,286	------	------	2,373	24,423
Trinidad and Tobago	4	100	11	130	1	23
Venezuela	56	1,308	1,098	10,440	94	1,870
Virgin Islands of the United States	16	300	1	15	3	29
	511,541	4,319,538	1,237,342	11,889,897	659,350	4,926,478

TABLE 48.—*Coke exported from the United States, 1922–1924, by months*

Month	1922		1923		1924	
	Net tons	Value	Net tons	Value	Net tons	Value
January	34,420	$266,809	87,090	$923,691	59,491	$499,248
February	35,318	273,620	79,508	855,678	60,202	512,358
March	28,487	236,703	109,224	1,124,789	59,057	458,213
April	31,822	243,417	226,002	2,405,744	42,769	308,893
May	24,414	201,124	185,520	1,816,332	45,130	328,619
June	32,581	258,902	71,503	680,325	54,027	391,569
July	31,008	251,669	67,717	600,728	54,861	412,180
August	29,255	293,043	111,145	896,665	47,385	360,316
September	39,729	448,061	106,936	930,039	46,820	317,651
October	43,247	503,716	87,065	744,987	62,450	420,927
November	43,005	492,495	55,287	490,443	64,094	442,140
December	138,255	849,979	50,345	420,476	63,064	474,364
	511,541	4,319,538	1,237,342	11,889,897	659,350	4,926,478

TABLE 49.—*Coke imported for consumption in the United States, 1909–1924*

Year	Net tons	Value	Year	Net tons	Value
1909	191,253	$736,120	1917	24,872	$146,451
1910	172,716	625,130	1918	30,168	221,880
1911	77,923	254,455	1919	16,486	140,653
1912	123,614	488,398	1920	41,143	403,175
1913	101,212	435,157	1921	30,990	336,394
1914	133,226	551,104	1922	94,228	802,987
1915	53,222	222,382	1923	85,002	862,596
1916	54,955	249,514	1924	82,833	795,477

TABLE 50.—*Coke imported into the United States, 1922–1924, by customs districts*

District	1922		1923		1924	
	Net tons	Value	Net tons	Value	Net tons	Value
Alaska	799	$5,704				
Buffalo	654	4,902	8,416	$140,935	14,241	$286,660
Chicago			1	50		
Hawaii	231	1,633	339	3,137		
Los Angeles	14,659	96,565	12,588	114,049	21,311	141,888
Maine and New Hampshire	1,365	12,688	342	3,349	299	2,139
Massachusetts	10,730	125,849				
Michigan	58	421	1,018	22,015	343	7,341
Montana and Idaho	16,593	185,338	25,697	275,107	8,699	90,227
New York	8,869	75,894	11,336	75,018		
Oregon	1,338	9,001	1,564	14,253	1,342	11,611
Philadelphia	3,068	37,637				
San Francisco	31,723	222,505	21,573	198,262	31,426	221,519
Vermont	87	702	84	771	86	621
Washington	4,054	24,148	2,044	15,650	5,086	33,471
	94,228	802,987	85,002	862,596	82,833	795,477

TABLE 51.—*Coke imported into the United States, 1922–1924, by countries*

Country	1922		1923		1924	
	Net tons	Value	Net tons	Value	Net tons	Value
Australia	903	$6,078				
Belgium	84	1,350				
Canada	18,572	200,483	36,366	$448,029	25,684	$397,868
China			(a)	10		
England	73,987	590,894	47,410	403,445	43,933	313,906
France			1	50		
Germany	342	2,067			5,638	30,264
Ireland			663	5,871	1,923	12,412
Netherlands					4,756	34,879
Scotland	340	2,115	562	5,191	899	6,148
	94,228	802,987	85,002	862,596	82,833	795,477

[a] Less than 1 ton.

SHIPMENTS BY RAIL AND WATER

TABLE 52.—*By-product coke loaded for shipment on originating railroads and waterways in the United States in 1924, by States, in net tons, as reported by the coke producers*

State	Route	Shipments	Production	Percentage of production shipped
	Railroads			
Alabama	Birmingham Southern	348, 623		
	Louisville & Nashville	485, 375		
	Mobile & Ohio	185, 244		
	St. Louis-San Francisco	191, 657		
	Southern	440, 144		
		1, 651, 043	4, 386, 372	37. 6
Colorado	Colorado & Wyoming	16, 559	523, 405	3. 2
Illinois	Alton & Southern	480		
	Baltimore & Ohio	240		
	Belt Railway of Chicago	307, 330		
	Chicago & Alton	7, 240		
	Chicago & Eastern Illinois	780		
	Chicago & Illinois Western	58, 959		
	Chicago, Burlington & Quincy	11, 540		
	Chicago, Peoria & St. Louis	13, 400		
	Chicago, Rock Island & Pacific	2, 280		
	Chicago Short Line	495, 274		
	Cleveland, Cincinnati, Chicago & St. Louis.	560		
	Elgin, Joliet & Eastern	339, 351		
	Illinois Central	18, 510		
	Illinois Traction	1, 260		
	Louisville & Nashville	280		
	Missouri, Kansas & Texas	420		
	Missouri Pacific	37, 809		
	Pennsylvania	1, 240		
	St. Louis Merchants Bridge Terminal	22, 880		
	St. Louis-San Francisco	1, 200		
	Southern	220		
	Wabash	8, 560		
		1, 329, 813	2, 355, 474	56. 5
Indiana	Chicago, Milwaukee & St. Paul	143, 197		
	Cleveland, Cincinnati, Chicago & St. Louis.	258, 214		
	Elgin, Joliet & Eastern	945, 333		
		1, 346, 744	4, 272, 435	31. 5
Massachusetts	Boston & Albany	163, 856		
	Boston & Maine	99, 764		
		263, 620	397, 640	66. 3
Michigan	Detroit & Toledo Shore Line	12, 160		
	Detroit, Toledo & Ironton	6, 720		
	Michigan Central	79, 616		
		98, 496	1, 770, 547	5. 6
Minnesota	Chicago, Milwaukee & St. Paul; Chicago, St. Paul, Minneapolis & Omaha; Great Northern; Northern Pacific.	35, 477		
	Duluth, Missabe & Northern	5, 623		
	Great Northern	92, 501		
	Northern Pacific	92, 501		
		226, 102	514, 764	43. 9
New Jersey	Delaware, Lackawanna & Western	39, 599		
	Erie	79, 941		
	Pennsylvania	23, 717		
		143, 257	869, 120	16. 5

TABLE 52.—*By-product coke loaded for shipment on originating railroads and waterways in the United States in 1924, by States, in net tons, as reported by the coke producers*—Continued

State	Route	Shipments	Production	Percentage of production shipped
	Railroads—Continued			
New York	Delaware, Lackawanna & Western	256,522		
	Lehigh Valley	3,998		
	New York Central	331,185		
	South Buffalo	143,211		
		734,916	1,600,669	45.9
Ohio	Baltimore & Ohio	193,846		
	Erie	79,319		
	Lake Terminal	78,287		
	Newburgh & South Shore	825,161		
	New York Central	98,400		
	Norfolk & Western	311,053		
	Pennsylvania	32,034		
	Toledo Terminal	40,211		
	Wheeling & Lake Erie	2,005		
		1,660,316	5,723,074	29.0
Pennsylvania	Baltimore & Ohio	3,540		
	Lehigh Valley	2,924		
	Mercer Valley	154,760		
	Pennsylvania	417,099		
	Philadelphia & Reading	240,014		
	Union	3,517,959		
	Upper Merion & Plymouth	317,235		
		4,653,531	8,426,155	55.2
Tennessee	Southern	[a] 82,559	75,720	[a] 109.0
Utah			97,350	
Washington	Northern Pacific	2,832	39,903	7.1
West Virginia	Baltimore & Ohio	276,034		
	Benwood & Wheeling Connecting Ry	6,332		
	Pennsylvania	155,660		
		438,026	998,914	43.9
Kentucky, Missouri, Rhode Island, and Wisconsin.	Chesapeake & Ohio; Chicago & North Western; Chicago, Milwaukee, & St. Paul; Minneapolis, St. Paul & Sault Ste. Marie; Missouri Pacific; New York, New Haven & Hartford.	971,341	1,121,908	86.6
	Total railroad shipments	13,619,155		
	Waterways			
Maryland	Patapsco River	113,836	810,118	14.1
Massachusetts	Mystic River	32,211	(b)	8.1
New Jersey	Delaware River	44,061		
	Hackensack River	443,496		
		487,557	(b)	56.1
Pennsylvania	Monongahela River	231,592	(b)	2.7
	Total waterway shipments	865,196		
	Grand total	14,484,351	33,983,568	42.6

[a] Includes shipments from stocks.

[b] Figures given under respective States above.

Table 53.—*By-product coke loaded for shipment on originating railroads and waterways in the United States in 1924, by routes, in net tons, as reported by the coke producers*

Route	State	Quantity		Percentage of total
		By States	Total	
Railroads				
Alton & Southern	Illinois	480	480	(a)
Baltimore & Ohio	do	240	473, 660	3. 3
	Ohio	193, 846		
	Pennsylvania	3, 540		
	West Virginia	276, 034		
Belt Railway of Chicago	Illinois	307, 330	307, 330	2. 1
Benwood & Wheeling Connecting Ry	West Virginia	6, 332	6, 332	(a)
Birmingham Southern	Alabama	348, 623	348, 623	2. 4
Boston & Albany	Massachusetts	163, 856	163, 856	1. 1
Boston & Maine	do	99, 764	99, 764	. 7
Chicago & Alton	Illinois	7, 240	7, 240	. 1
Chicago & Eastern Illinois	do	780	780	(a)
Chicago & Illinois Western	do	58, 959	58, 959	. 4
Chicago, Burlington & Quincy	do	11, 540	11, 540	. 1
Chicago, Milwaukee & St. Paul	Indiana and Wisconsin	436, 330	436, 330	3. 0
Chicago, Peoria & St. Louis	Illinois	13, 400	13, 400	. 1
Chicago, Rock Island & Pacific	do	2, 280	2, 280	(a)
Chicago Short Line	do	495, 274	495, 274	3. 4
Cleveland, Cincinnati, Chicago & St. Louis	do	560	258, 774	1. 8
	Indiana	258, 214		
Colorado & Wyoming	Colorado	16, 559	16, 559	. 1
Delaware, Lackawanna & Western	New Jersey	39, 599	296, 121	2. 0
	New York	256, 522		
Detroit & Toledo Shore Line	Michigan	12, 160	12, 160	. 1
Detroit, Toledo & Ironton	do	6, 720	6, 720	. 1
Duluth, Missabe & Northern	Minnesota	5, 623	5, 623	(a)
Elgin, Joliet & Eastern	Illinois	339, 351	1, 284, 684	8. 9
	Indiana	945, 333		
Erie	New Jersey	79, 941	159, 260	1. 1
	Ohio	79, 319		
Great Northern	Minnesota	92, 501	92, 501	. 6
Illinois Central	Illinois	18, 510	18, 510	. 1
Illinois Traction	do	1, 260	1, 260	(a)
Lake Terminal	Ohio	78, 287	78, 287	. 5
Lehigh Valley	New York	3, 998	6, 922	. 1
	Pennsylvania	2, 924		
Louisville & Nashville	Alabama	485, 375	485, 655	3. 4
	Illinois	280		
Mercer Valley	Pennsylvania	154, 760	154, 760	1. 1
Michigan Central	Michigan	79, 616	79, 616	. 5
Missouri, Kansas & Texas	Illinois	420	420	
Missouri Pacific	Illinois and Missouri	279, 852	279, 852	1. 9
Mobile & Ohio	Alabama	185, 244	185, 244	1. 3
Newburgh & South Shore	Ohio	825, 161	825, 161	5. 7
New York Central	New York	331, 185	429, 585	3. 0
	Ohio	98, 400		
Norfolk & Western	do	311, 053	311, 053	2. 1
Northern Pacific	Minnesota	92, 501	95, 333	. 7
	Washington	2, 832		
Pennsylvania	Illinois	1, 240	629, 750	4. 3
	New Jersey	23, 717		
	Ohio	32, 034		
	Pennsylvania	417, 099		
	West Virginia	155, 660		
Philadelphia & Reading	Pennsylvania	240, 014	240, 014	1. 7
St. Louis Merchants Bridge Terminal	Illinois	22, 880	22, 880	. 2
St. Louis-San Francisco	Alabama	191, 657	192, 857	1. 3
	Illinois	1, 200		
South Buffalo	New York	143, 211	143, 211	1. 0
Southern	Alabama	440, 144	522, 923	3. 6
	Illinois	220		
	Tennessee	82, 559		
Toledo Terminal	Ohio	40, 211	40, 211	. 3
Union	Pennsylvania	3, 517, 959	3, 517, 959	24. 3
Upper Merion & Plymouth	do	317, 235	317, 235	2. 2
Wabash	Illinois	8, 560	8, 560	. 1
Wheeling & Lake Erie	Ohio	2, 005	2, 005	(a)
Chicago, Milwaukee & St. Paul; Chicago, St. Paul, Minneapolis & Omaha; Great Northern; Northern Pacific.	Minnesota	35, 477	35, 477	. 2
Chesapeake & Ohio; Chicago & North Western; Minneapolis, St. Paul & Sault Ste. Marie; New York, New Haven & Hartford.	Kentucky, Rhode Island, and Wisconsin.	436, 165	436, 165	3. 0
Total railroad shipments		13, 619, 155	13, 619, 155	94. 0

[a] Less than 0.1 per cent.

TABLE 53.—*By-product coke loaded for shipment on originating railroads and waterways in the United States in 1924, by routes, in net tons, as reported by the coke producers*—Continued

Route	State	Quantity		Percentage of total
		By States	Total	
Waterways				
Delaware River	New Jersey	44,061	44,061	0.3
Hackensack River	do	443,496	443,496	3.1
Monongahela River	Pennsylvania	231,592	231,592	1.6
Mystic River	Massachusetts	32,211	32,211	.2
Patapsco River	Maryland	113,836	113,836	.8
Total waterway shipments		865,196	865,196	6.0
Grand total		14,484,351	14,484,351	100.0

TABLE 54.—*Beehive coke loaded for shipment on originating railroads and waterways in the United States in 1924, by States, in net tons, as reported by the coke producers*

State	Railroad	Shipments	Production	Percentage of production shipped [a]
Alabama	Louisville & Nashville	127,793	154,686	82.6
Colorado	Colorado & Wyoming	65,436		
	Denver & Rio Grande Western	150,004		
		215,440	212,115	101.6
Georgia	Central of Georgia	8,532	8,081	105.6
Kentucky	Chesapeake & Ohio	13,304		
	Louisville & Nashville	65,944		
		79,248	79,248	100.0
New Mexico	Southern Pacific	83,678	83,070	100.7
Ohio			109,625	
Pennsylvania	Baltimore & Ohio	965,916		
	Buffalo & Susquehanna	201,613		
	Buffalo, Rochester & Pittsburgh	62,968		
	Ligonier Valley	103,439		
	Monongahela	2,235,858		
	Pennsylvania	3,670,733		
	Pittsburgh & Lake Erie	169,632		
	Reynoldsville & Falls Creek	48,872		
	Washington Run	148,925		
		7,607,956	8,501,282	89.5
Tennessee	Nashville, Chattanooga & St. Louis	7,785		
	Southern	14,457		
		22,242	131,755	16.9
Utah	Denver & Rio Grande Western	159,744	159,744	100.0
Virginia	Chesapeake & Ohio	34,882		
	Interstate	352,537		
	Louisville & Nashville	11,228		
	Norfolk & Western	48,684		
	Interstate; Louisville & Nashville; Norfolk & Western; Southern.	43,228		
		490,559	485,064	101.1
Washington	Northern Pacific	31,602	31,712	99.7
West Virginia	Baltimore & Ohio	93,791		
	Chesapeake & Ohio	110,343		
	New York Central	29,504		
	Norfolk & Western	78,396		
	Western Maryland	16,890		
		328,924	329,655	99.8
	Total railroad shipments	9,155,718		
	Total waterway shipments (Monongahela River, Pa.).	321,716	([b])	3.8
	Grand total	9,477,434	10,286,037	92.1

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[a] Excess of shipments over production represents inclusion of screenings or withdrawal from stock.

[b] Production shown above.

TABLE 55.—*Beehive coke loaded for shipment on originating railroads and waterways in the United States in 1924, by routes, in net tons, as reported by the coke producers*

Route	State	Quantity		Percentage of total
		By States	Total	
Railroads:				
Baltimore & Ohio	Pennsylvania	965, 916	1, 059, 707	11. 2
	West Virginia	93, 791		
Buffalo & Susquehanna	Pennsylvania	201, 613	201, 613	2.
Buffalo, Rochester & Pittsburgh	do	62, 968	62, 968	. 7
Central of Georgia	Georgia	8, 532	8, 532	. 1
Chesapeake & Ohio	Kentucky	13, 304	158, 529	1. 7
	Virginia	34, 882		
	West Virginia	110, 343		
Colorado & Wyoming	Colorado	65, 436	65, 436	. 7
Denver & Rio Grande Western	do	150, 004	309, 748	3. 3
	Utah	159, 744		
Interstate	Virginia	352, 537	352, 537	3. 7
Ligonier Valley	Pennsylvania	103, 439	103, 439	1. 1
Louisville & Nashville	Alabama	127, 793	204, 965	2. 2
	Kentucky	65, 944		
	Virginia	11, 228		
Monongahela	Pennsylvania	2, 235, 858	2, 235, 858	23. 6
Nashville, Chattanooga & St. Louis	Tennessee	7, 785	7, 785	. 1
New York Central	West Virginia	29, 504	29, 504	. 3
Norfolk & Western	Virginia	48, 684	127, 080	1. 3
	West Virginia	78, 396		
Northern Pacific	Washington	31, 602	31, 602	. 3
Pennsylvania	Pennsylvania	3, 670, 733	3, 670, 733	38. 7
Pittsburgh & Lake Erie	do	169, 632	169, 632	1. 8
Reynoldsville & Falls Creek	do	48, 872	48, 872	. 5
Southern	Tennessee	14, 457	14, 457	. 1
Southern Pacific	New Mexico	83, 678	83, 678	. 9
Washington Run	Pennsylvania	148, 925	148, 925	1. 6
Western Maryland	West Virginia	16, 890	16, 890	. 2
Interstate; Louisville & Nashville; Norfolk & Western; Southern.	Virginia	43, 228	43, 228	. 4
Total railroad shipments		9, 155, 718	9, 155, 718	96. 6
Waterways: Monongahela River	Pennsylvania	321, 716	321, 716	3. 4
Grand total		9, 477, 434	9, 477, 434	100. 0

WORLD PRODUCTION

TABLE 56.—*Coke produced in the principal countries of the world, 1920–1924*

[In metric tons of 2,204.6 pounds. Gas-house coke is not included]

Country	1920	1921	1922	1923	1924
Australia:					
New South Wales	576, 678	601, 600	244, 085	589, 689	573, 420
Queensland	19, 968	7, 412	5, 388	5, 330	7, 230
Belgium	1, 835, 400	1, 402, 610	2, 849, 884	4, 179, 964	4, 216, 580
Canada	1, 106, 081	861, 787	605, 814	1, 037, 985	833, 691
China (exports)	19, 410	35, 721	45, 097	29, 795	27, 606
Czechoslovakia	1, 590, 623	1, 135, 837	639, 290	1, 474, 531	1, 804, 885
France	1, 761, 418	1, 860, 706	2, 362, 280	4, 287, 109	5, 367, 415
Germany [a]	26, 720, 535	29, 078, 013	31, 022, 480	14, 203, 569	25, 100, 888
India—British [b]	365, 465	276, 927	327, 676	307, 764	371, 944
Italy	95, 727	34, 022	167, 953	275, 235	309, 971
Japan:					
Japan proper—					
Natural coke	67, 172	64, 365	([c])	118, 201	104, 030
Metallurgical	903, 225	668, 550	720, 554	658, 053	832, 429
Taiwan	([c])	32, 000	([c])	([c])	([c])
Netherlands	138, 987	228, 605	451, 758	671, 687	975, 779
Peru	([c])	([c])	([c])	45, 000	20, 000
Poland	([d])	([d])	[e] 678, 972	1, 376, 194	949, 758
Rhodesia (Southern)	95, 526	116, 316	97, 670	122, 897	137, 078
Russia	[f] 10, 000	[f] 104, 025	[f] 112, 333	([c])	[g] 723, 800
Spain	280, 717	446, 087	311, 423	651, 966	724, 082
Union of South Africa	19, 674	24, 224	38, 405	53, 926	67, 561
United Kingdom [h]	12, 813, 849	4, 647, 382	9, 180, 765	13, 633, 678	12, 958, 049
United States	46, 579, 196	22, 940, 425	33, 678, 161	51, 688, 879	40, 160, 500

[a] Includes all of Upper Silesia in 1920–21, and January–May, 1922; German Upper Silesia, June–December, 1922; and Saar in all five years.

[b] Represents only coke made at collieries.

[c] Data not available.

[d] Included under Germany.

[e] Includes output for June to December of that part of Upper Silesia allocated to Poland.

[f] Output of the Donetz Basin.

[g] Year ended Sept. 30.

[h] In Great Britain the production of gas-house coke, not included above, is especially important and was as follows: 1920, 8,440,471 metric tons; 1921, 6,907,608 tons; 1922, 11,037,012 tons; 1923, 11,692,948 tons; 1924, 12,279,666 tons.

COKE-OVEN BY-PRODUCTS

SUMMARY TABLES

TABLE 57.—*By-products obtained from coke-oven operations in the United States, 1923–24*

Product	Production	Sales		
		Quantity	Value	
			Total	Average
1923				
Tar gallons	440, 907, 109	211, 739, 469	$9, 250, 552	$0. 044
Ammonia:				
Sulphate pounds	915, 926, 762	884, 952, 912	25, 954, 413	. 029
Ammonia liquor (NH_3 content) [a] do	58, 699, 902	57, 859, 699	5, 754, 463	. 099
			31, 708, 876	
Sulphate equivalent of all forms do	1, 150, 726, 370	1, 116, 391, 708		
Gas:				
Used under boilers, etc M cubic feet	[b] 601, 155, 293	33, 740, 758	1, 820, 808	. 054
Used in steel or affiliated plants do		200, 099, 200	22, 646, 134	. 113
Distributed through city mains do		65, 143, 515	23, 116, 578	. 355
Sold for industrial use do		19, 458, 781	4, 025, 700	. 207
		318, 442, 254	51, 609, 220	. 162

[a] Includes an unknown amount of sulphate sold on the basis of NH_3 content.

[b] Includes gas wasted and gas used for heating retorts.

TABLE 57.—*By-products obtained from coke-oven operations in the United States, 1923-24*—Continued

Product	Production	Sales		
		Quantity	Value	
			Total	Average
1923—Continued				
Light oil and derivatives:				
Crude light oil.....gallons	[c] 135,647,175	6,539,368	$683,545	$0.105
Benzol, crude.....do	4,503,428	4,348,400	768,486	.177
Benzol, refined.....do	12,364,043	12,375,782	3,070,751	.248
Motor benzol.....do	80,467,883	80,480,326	13,145,833	.163
Toluol, crude.....do	37,777	6,097	978	.160
Toluol, refined.....do	2,847,517	2,628,686	765,052	.291
Solvent naphtha.....do	4,162,178	3,399,904	608,084	.179
Other light-oil products.....do	439,253	198,098	10,605	.054
	[d]104,822,079	109,976,661	19,053,334	.173
Naphthalene:				
Crude.....pounds	11,872,007	10,047,427	174,216	.017
Refined.....do	1,139,922	1,198,206	65,483	.055
	13,011,929	11,245,633	239,699	.021
Other products	----------	----------	214,264	----------
Value of all by-products sold	----------	----------	112,075,945	----------
1924				
Tar.....gallons	422,074,326	209,979,999	9,623,520	.046
Ammonia:				
Sulphate.....pounds	893,127,071	931,329,570	22,522,248	.024
Ammonia liquor (NH_3 content) [a].....do	49,029,524	47,665,811	4,656,428	.098
	----------	----------	27,178,676	----------
Sulphate equivalent of all forms.....do	1,089,245,167	1,121,992,814	----------	----------
Gas:				
Used under boilers, etc.....M cubic feet	[b] 541,101,050	29,794,046	1,729,013	.058
Used in steel or affiliated plants.....do		187,171,883	21,007,607	.112
Distributed through city mains.....do		65,676,867	23,486,416	.358
Sold for industrial use.....do		18,561,057	3,561,911	.192
	----------	301,203,853	49,784,947	.165
Light oil and derivatives:				
Crude light oil.....gallons	[e] 128,956,955	7,840,582	652,467	.083
Benzol, crude.....do	3,856,908	3.860,408	831,419	.215
Benzol, refined.....do	14,278,117	13,880,200	2,905,237	.209
Motor benzol.....do	73,768,811	72,921,224	11,066,652	.152
Toluol, crude.....do	234,244	245,079	51,041	.208
Toluol, refined.....do	2,951,187	2,986,423	718,641	.241
Solvent naphtha.....do	4,474,220	3,884,585	724,874	.187
Other light-oil products.....do	1,364,528	1,077,842	78,934	.073
	[d]100,928,015	106,696,343	17,029,265	.160
Naphthalene:				
Crude.....pounds	8,378,666	7,891,116	116,305	.015
Refined.....do	13,302	327,957	11,903	.036
	8,391,968	8,219,073	128,208	.016
Other products	----------	----------	57,891	----------
Value of all by-products sold	----------	----------	103,802,507	----------

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[a] Includes an unknown amount of sulphate sold on the basis of NH_3 content.

[b] Includes gas wasted and gas used for heating retorts.

[c] Refined on the premises to make the derived products shown, 132,517,389 gallons of crude oil.

[d] Total gallons of derived products.

[e] Refined on the premises to make the derived products shown, 125,580,743 gallons of crude oil.

TABLE 58.—*Value of by-products and of coke, including breeze, per ton of coke produced in the United States, 1915–1924*

Product	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924
Ammonia and its compounds	$0.70	$0.74	$0.79	$1.02	$1.06	$1.16	$0.84	$0.78	$0.84	$0.80
Light oil and its derivatives (including naphthalene)	.52	1.58	1.30	.99	.50	.61	.59	.55	.51	.50
Surplus gas sold or used	.61	.57	.51	.53	.66	1.05	1.31	1.35	1.37	1.46
Tar	.25	.26	.25	.24	.28	.21	.29	.22	.25	.28
Miscellaneous products	.03	.01	.06	.09	.03	.01	.01	.01	.01	-------
	2.11	3.16	2.91	2.87	2.53	3.04	3.04	2.91	2.98	3.04
Tar used	([a])	([a])	([a])	.08	.09	.22	.26	.23	.26	.29
Breeze produced	([b])	.09	.10	.12	.10	.14	.16	.18	.24	.18
Total value of by-products, including those not sold	2.19	3.25	3.01	3.07	2.72	3.40	3.46	3.32	3.48	3.51
Value of coke produced	3.45	3.95	6.18	[c] 7.42	[c] 6.37	[c] 10.15	[c] 5.95	[c] 6.59	[c] 6.85	[c] 5.76
Total value of coke and by-products	5.64	7.20	9.19	10.49	9.09	13.55	9.41	9.91	10.33	9.27

[a] Included in tar sold.
[b] Estimate included in total.
[c] The average receipts per ton of coke sold during these years were $7.88 in 1918, $6.58 in 1919, $10.77 in 1920, $7.72 in 1921, $8.45 in 1922, $8.53 in 1923, and $6.90 in 1924.

TABLE 59.—*Average receipts per unit of coke-oven by-products sold, 1913–1924*

[The figures in this table for 1913 to 1917 represent "average value of by-products produced and sold." For 1918 to 1924 they represent "average receipts from sales." The two sets of figures are probably comparable for practical purposes]

	Tar	Sulphate	Surplus gas	Benzol, refined	Motor benzol	Toluol, refined	Solvent naphtha	Naphthalene	
								Crude	Refined
Unit	Gallon	Pound	M cubic feet	Gallon	Gallon	Gallon	Gallon	Pound	Pound
	Cents	*Cents*	*Cents*	*Cents*	*Cents*		*Cents*	*Cents*	
1913	2.5	3.1	8.8	[a] 27	([b])	[a] $0.29	[a] 25	([b])	
1914	2.6	2.8	9.8	[a] 26	([b])	[a] .33	[a] 25	([b])	
1915	2.6	2.8	10.2	56.8	([c])	2.45	24.0	[d] 10.0	
1916	2.6	3.1	9.8	62.4	([c])	2.85	28.4	[d] 3.4	
1917	2.7	3.4	8.7	45.0	([c])	1.37	16.6	[d] 3.3	
1918	3.2	4.5	8.7	27.5	([c])	1.43	14.1	2.8	6.6
1919	3.2	3.8	8.6	20.6	([e])	.263	15.2	2.0	4.1
1920	3.7	4.3	14.0	26.0	22.7	.300	18.1	2.7	6.1
1921	4.2	2.5	16.8	23.9	17.9	.283	17.7	2.5	5.6
1922	4.0	2.5	16.7	28.5	19.1	.292	18.8	1.6	5.0
1923	4.4	2.9	16.2	24.8	16.3	.291	17.9	1.7	5.5
1924	4.6	2.4	16.5	20.9	15.2	.241	18.7	1.5	3.6

[a] Trade quotations, New York market; used to avoid disclosing individual operators' reports.
[b] No data.
[c] Not reported during the war.
[d] Crude and refined, not separated prior to 1918.
[e] Data uncertain.

TABLE 60.—*Average yield of coke and by-products per net ton of coal charged in by-product ovens in the United States, 1917–1924*

Product	1917	1918	1919	1920	1921	1922	1923	1924
Coke...pounds..	1,424	1,410	1,402	1,395	1,376	1,390	1,386	1,386
Tar...gallons..	7.0	7.1	8.1	8.2	8.8	8.0	8.1	8.6
Ammonium sulphate (or equivalent)...pounds..	17.8	18.9	20.8	21.4	22.8	21.9	21.2	22.2
Light oil...gallons..	(a)	2.4	2.7	[b] 2.7	[b] 2.8	[b] 2.7	[b] 2.7	[b] 2.9
Gas:								
Total...M cubic feet..	10.7	10.4	11.6	10.8	10.8	10.8	11.1	11.0
Surplus sold or used...do....	4.1	4.3	5.4	5.2	5.4	5.6	5.9	6.1
Burned in coking process..do....	6.0	5.7	5.9	5.4	5.1	5.0	5.0	4.7
Wasted...do....	.6	.4	.3	.2	.3	.2	.2	.2

[a] Records not comparable.

[b] Average for plants now recovering light oil.

TAR

TABLE 61.—*Disposal of coke-oven tar produced in the United States, 1923–24, in gallons*

	1923			1924		
	Furnace plants	Other plants	Total	Furnace plants	Other plants	Total
Sold...	137,761,447	73,978,022	211,739,469	141,125,162	68,854,837	209,979,999
Used:						
As fuel under boilers...	9,843,154	....	9,843,154	8,345,940	....	8,345,940
In open-hearth or other metallurgical plants..	212,287,166	....	212,287,166	205,128,305	....	205,128,305

TABLE 62.—*Coke-oven tar produced and sold in the United States in 1924, by States*

State	Produced (gallons)		Sold			Used (gallons)			On hand Dec. 31 (gallons)
	Total	Per ton of coal coked	Gallons	Value		As fuel under boilers	In open-hearth or affiliated plants	Otherwise	
				Total	Average				
Alabama	52,404,197	8.2	29,266,001	$1,137,229	$0.039	209,010	22,904,770	271,085	2,450,096
Colorado	7,170,745	9.5	10,176	(a)	(a)		7,190,522	37,151	42,561
Illinois	27,001,702	7.9	20,490,934	1,023,968	.050		4,633,736	14,000	3,243,694
Indiana	35,347,438	6.1	5,131,995	262,671	.051		31,020,138		2,604,322
Maryland	7,548,314	6.8	7,732,432	(a)	(a)			113	915,718
Massachusetts	4,741,825	8.3	4,746,919	(a)	(a)				1,528,773
Michigan	18,218,475	7.6	12,017,359	625,541	.052	5,754,947			2,564,571
Minnesota	6,254,578	8.4	5,090,970	234,767	.046		1,080,273	195,490	353,308
New Jersey	10,110,765	8.4	10,035,240	(a)	(a)				443,919
New York	19,610,040	8.7	17,349,558	708,479	.041		3,028,335	30,262	1,592,253
Ohio	75,976,098	9.0	40,018,018	2,029,783	.051		36,043,407		4,192,221
Pennsylvania	124,442,164	9.9	26,490,174	1,016,401	.038	2,381,983	97,284,936	17,628	4,553,316
Tennessee	915,370	8.9	967,360	40,291	.042				29,166
Utah	1,972,392	10.4	1,795,597	(a)	(a)				176,795
Washington	584,990	8.2	559,862	39,190	.070			2,005	44,729
West Virginia	16,749,781	11.3	15,111,846	800,171	.053		1,942,188	42,016	419,727
Kentucky, Missouri, Rhode Island, and Wisconsin	13,025,452	8.3	13,165,558	666,886	.051			1,229	1,055,971
Undistributed				1,038,143	.043				
	422,074,326	8.6	209,979,999	9,623,520	.046	8,345,940	205,128,305	610,979	26,211,140

[a] Included under "Undistributed."

AMMONIA

TABLE 63.—*Ammonia produced at coke-oven plants in the United States in 1924, in pounds*

State	Sulphate	Liquor (NH_3 content)	Sulphate equivalent of all forms	
			Total	Per ton of coal coked
Alabama	140, 037, 615	1, 142, 936	144, 609, 359	22. 7
Colorado	15, 844, 637		15, 844, 637	21. 0
Illinois	57, 587, 338	3, 903, 321	73, 200, 622	21. 5
Indiana	65, 621, 219	7, 237, 931	94, 572, 943	16. 2
Maryland	21, 874, 600		21, 874, 600	19. 8
Massachusetts	11, 034, 000		11, 034, 000	19. 2
Michigan	18, 761, 632	9, 844, 448	58, 139, 424	24. 1
Minnesota	11, 122, 515	1, 100, 628	15, 525, 027	20. 9
New Jersey	22, 135, 741	1, 330, 296	27, 456, 925	22. 8
New York	34, 366, 648	3, 569, 726	48, 645, 552	21. 5
Ohio	169, 980, 572	7, 581, 980	200, 308, 492	23. 8
Pennsylvania	285, 721, 370	2, 150, 964	294, 325, 226	23. 4
Tennessee	2, 757, 281		2, 757, 281	26. 7
Utah	4, 824, 306		4, 824, 306	25. 4
Washington		585, 007	2, 340, 028	33. 0
West Virginia	31, 457, 597	1, 357, 525	36, 887, 697	24. 8
Kentucky, Missouri, Rhode Island, and Wisconsin		9, 224, 762	36, 899, 048	23. 4
	893, 127, 071	49, 029, 524	1, 089, 245, 167	22. 2

TABLE 64.—*Ammonia sold by coke-oven plants in the United States in 1924*

State	Sulphate			Liquor (NH_3 content)			Total (sulphate equivalent of all forms)	
	Pounds	Value		Pounds	Value		Pounds	Value
		Total	Average		Total	Average		
Alabama	149, 907, 897	$3, 809, 514	$0. 025	1, 096, 868	$115, 709	$0. 105	154, 295, 369	$3, 925, 223
Colorado	15, 771, 300	([a])	([a])				15, 771, 300	([a])
Illinois	64, 505, 409	1, 604, 785	. 025	4, 196, 063	430, 646	. 103	81, 289, 661	2, 035, 431
Indiana	74, 735, 602	1, 578, 711	. 021	7, 989, 792	690, 769	. 086	106, 694, 770	2, 269, 480
Maryland	22, 276, 320	([a])	([a])				22, 276, 320	([a])
Massachusetts	11, 770, 000	([a])	([a])				11, 770, 000	([a])
Michigan	13, 895, 098	375, 163	. 027	6, 555, 517	806, 135	. 123	40, 117, 166	1, 181, 298
Minnesota	12, 859, 271	322, 180	. 025	1, 088, 813	92, 565	. 085	17, 214, 523	414, 745
New Jersey	23, 012, 340	([a])	([a])	1, 344, 445	([a])	([a])	28, 390, 120	([a])
New York	34, 859, 151	873, 043	. 025	3, 346, 938	379, 701	. 113	48, 246, 903	1, 252, 744
Ohio	172, 212, 689	4, 257, 287	. 025	7, 984, 786	715, 606	. 090	204, 151, 833	4, 972, 893
Pennsylvania	297, 145, 904	6, 735, 159	. 023	2, 568, 329	210, 147	. 082	307, 419, 220	6, 945, 306
Tennessee	2, 718, 600	70, 509	. 026				2, 718, 600	70, 509
Utah	4, 744, 858	([a])	([a])				4, 744, 858	([a])
Washington				584, 810	42, 454	. 073	2, 339, 240	42, 454
West Virginia	30, 915, 131	807, 381	. 026	1, 428, 735	209, 529	. 147	36, 630, 071	1, 016, 910
Kentucky, Missouri, Rhode Island, and Wisconsin				9, 480, 715	844, 977	. 089	37, 922, 860	844, 977
Undistributed		2, 088, 516	. 027		118, 190	. 088		2, 206, 706
	931, 329, 570	22, 522, 248	. 024	47, 665, 811	4, 656, 428	. 098	1,121,992,814	27, 178, 676

[a] Included under "Undistributed."

TABLE 65.—*Average monthly prices of sulphate of ammonia per 100 pounds, 1909–1924*

[Quotations, 1909–1916, abstracted from Oil, Paint, and Drug Reporter, at New York; 1917–1923, from Iron Trade Review, f. o. b. producers' works. Compiled by C. G. Atwater, of the Barrett Co. 1924 data from Iron Trade Review, Jan. 1, 1925, p. 84]

	1909	1910	1911	1912	1913	1914	1915	1916
January	$2.91	$2.73	$2.97½	$3.20¾	$3.28	$2.90	$2.71¼	$3.96½
February	2.99	2.73¾	3.08¾	3.24¼	3.30	2.85	2.98¾	3.96¼
March	2.98¼	2.83¾	3.11¼	3.28	3.30	2.85	3.16	3.92½
April	2.97¼	2.77	3.11¼	3.38	3.30	2.85	3.10⅝	3.68¾
May	2.91	2.82	3.07½	3.40	3.30	2.70	3.20	3.57½
June	2.90	2.78¾	3.03¾	3.40	3.12	2.55	3.22½	3.53
July	2.88	2.78¾	3.07¼	3.25	3.00	2.52	3.41	3.43½
August	2.75½	2.79¼	3.16¼	3.22½	2.98	2.60	3.53	3.58¾
September	2.65	2.87½	3.16¼	3.29	3.07	2.76⅞	3.37½	3.77½
October	2.65	2.92½	3.18	3.28	3.10	2.67½	3.37½	4.02½
November	2.62½	2.93¾	3.18	3.20⅝	3.06¼	2.67½	3.57	4.21¼
December	2.64	2.96¼	3.20	3.22½	2.95	2.67½	3.93¾	4.32½
Average	2.82	2.83	3.11	3.28	3.14	2.71	3.30	3.83

	1917	1918	1919	1920	1921	1922	1923	1924
January	$4.12	$5.03	$4.68	$4.00	$3.37½	$2.20	$3.10	$2.72½
February	4.18	5.22½	4.50	4.00	3.12½	2.35	3.15⅝	2.72½
March	(a)	5.40½	4.25	4.55	2.92½	2.60½	3.19½	2.72½
April	(a)	5.46	4.00	4.55	2.57½	2.65	3.22½	2.65
May	4.72½	5.59½	3.80	4.55	2.45	2.67	3.21½	2.62½
June	4.80	5.10	3.60	4.55	2.45	2.72	3.13¾	2.57½
July	4.90	4.50	3.40	4.55	2.35	2.82	3.10	2.50
August	4.90	4.50	3.53	4.80	2.00	2.82	3.07½	2.35
September	4.92½	4.50	3.53	4.80	1.95	2.90	3.02½	2.50
October	4.95	4.50	3.57	4.25	2.20	3.05	3.01¼	2.60
November	4.92½	4.50	3.78	3.75	2.20	3.07	2.93¾	2.65
December	4.90	4.86	3.93	3.38	2.20	3.12	2.76¼	2.67½
Average	4.73	4.93	3.88	4.31	2.48	2.75	3.08	2.61

[a] No market.

BENZOL AND LIGHT-OIL PRODUCTS

TABLE 66.—*Producers' price per gallon of pure benzol f. o. b. works and tank-wagon price of gasoline, 1920–1924, by months*

[Prices of benzol are those quoted by Iron Trade Review; of tank-wagon gasoline, average for five cities, computed by J. E. Pogue]

Month	1920		1921		1922		1923		1924	
	Benzol	Gasoilne	Benzol	Gasoline	Benzol	Gasoline	Benzol	Gasoline	Benzol	Gasoline
January	$0.290	$0.231	$0.330	$0.276	$0.290	$0.214	$0.300	$0.193	$0.220	$0.152
February	.290	.237	.330	.250	.290	.211	.300	.201	.250	.177
March	.300	.251	.300	.240	.290	.211	.300	.206	.250	.180
April	.310	.259	.300	.236	.290	.217	.300	.199	.250	.180
May	.330	.262	.300	.220	.290	.230	.290	.189	.250	.178
June	.330	.268	.330	.214	.290	.235	.260	.195	.245	.169
July	.380	.268	.330	.206	.300	.236	.260	.194	.250	.159
August	.380	.275	.330	.201	.300	.222	.260	.172	.250	.154
September	.380	.281	.330	.193	.300	.221	.240	.151	.250	.151
October	.380	.281	.330	.201	.300	.213	.220	.142	.250	.136
November	.380	.279	.330	.214	.300	.200	.215	.131	.250	.134
December	.330	.278	.330	.218	.300	.198	.210	.131	.250	.134
Average	.340	.265	.323	.223	.295	.217	.263	.175	.247	.159

TABLE 67.—*Monthly spot prices of coal-tar products in New York market, 1921–1924*

[As quoted by Oil, Paint, and Drug Reporter. Figures are averages of high and low quotations for each month]

Month	Benzol (90 per cent), per gallon				Toluol, per gallon			
	1921	1922	1923	1924	1921	1922	1923	1924
January	$0.275	$0.270	$0.270	$0.210	$0.300	$0.300	$0.300	$0.260
February	.270	.270	.295	.230	.300	.300	.300	.260
March	.270	.270	.320	.230	.300	.300	.300	.260
April	.270	.270	.320	.230	.300	.300	.300	.260
May	.270	.270	.270	.230	.300	.300	.300	.260
June	.270	.270	.250	.230	.300	.300	.300	.260
July	.270	.270	.250	.230	.300	.300	.300	.260
August	.270	.270	.250	.230	.270	.300	.300	.260
September	.250	.270	.250	.230	.270	.300	.300	.260
October	.250	.270	.210	.230	.270	.300	.260	.260
November	.250	.270	.210	.230	.270	.300	.260	.260
December	.260	.270	.210	.230	.270	.300	.260	.260
Average	.265	.270	.259	.228	.288	.300	.290	.260

Month	Solvent naphtha, per gallon				Naphthalene flakes, per pound			
	1921	1922	1923	1924	1921	1922	1923	1924
January	$0.280	$0.250	$0.270	$0.270	$0.079	$0.065	$0.059	$0.065
February	.280	.250	.270	.280	.080	.065	.068	.063
March	.280	.250	.270	.280	.077	.062	.085	.061
April	.250	.250	.270	.280	.077	.062	.095	.055
May	.250	.250	.270	.240	.072	.061	.090	.053
June	.250	.270	.270	.240	.075	.062	.086	.050
July	.250	.270	.270	.240	.071	.061	.080	.050
August	.250	.270	.270	.240	.069	.060	.075	.050
September	.250	.270	.270	.240	.066	.060	.069	.053
October	.250	.270	.270	.240	.065	.060	.068	.045
November	.250	.270	.270	.240	.067	.059	.065	.050
December	.250	.270	.270	.240	.067	.057	.060	.055
Average	.258	.262	.270	.253	.072	.061	.075	.055

TABLE 68.—*Production of motor fuel in the United States, 1918–1924, in gallons*

Year	Gasoline production of petroleum refineries	Natural-gas gasoline (total production)	Benzol produced, all grades, including motor benzol		
			Coke ovens	Gas works, including oil and water gas	Tar refineries, etc.[a]
1918	3,570,000,000	283,000,000	44,805,000	[b] 5,633,000	3,015,000
1919	3,958,000,000	352,000,000	61,068,000	([c])	1,826,000
1920	4,883,000,000	385,000,000	72,994,000	[d] 502,000	876,000
1921	5,154,000,000	450,000,000	54,459,000	([e])	2,172,000
1922	6,202,000,000	506,000,000	70,112,000	([e])	[f] 775,000
1923	7,556,000,000	816,000,000	97,335,000	([e])	[f] 395,000
1924	8,960,000,000	934,000,000	91,904,000	([e])	[f] 630,000

[a] As reported to the U. S. Tariff Commission.

[b] Of this only 2,177,000 gallons was sold, the balance being returned to the gas.

[c] Data not available in comparable form.

[d] Quantity sold, used because of apparent double counting between production figures of crude and refined benzol.

[e] Can not be shown without disclosing individual returns.

[f] Does not include a small amount of motor benzol which can not be shown without disclosing individual returns.

TABLE 69.—*Number of plants making light oil or derivatives, 1923–24*

State	1923				1924			
	Total making coke	Making crude light oil	Making any refined product	Making motor benzol	Total making coke	Making crude light oil	Making any refined product	Making motor benzol
Alabama	7	7	5	4	7	7	5	5
Colorado	1	1	1	1	1	1	1	1
Illinois	6	4	3	3	6	4	3	2
Indiana	6	5	5	5	6	4	4	4
Kentucky	1	1	--------	--------	1	1	--------	--------
Maryland	1	1	1	1	1	1	1	1
Massachusetts	1	--------	--------	--------	1	--------	--------	--------
Michigan	3	2	1	1	5	2	2	1
Minnesota	3	2	3	2	3	2	2	2
Missouri	1	1	1	--------	1	1	1	--------
New Jersey	2	--------	--------	--------	2	--------	--------	--------
New York	4	4	3	3	5	5	3	3
Ohio	11	11	8	8	13	12	9	9
Pennsylvania	10	9	7	7	10	8	7	7
Rhode Island	1	--------	--------	--------	1	--------	1	--------
Tennessee	1	1	1	1	1	1	1	1
Utah	--------	--------	--------	--------	1	1	1	1
Washington	1	--------	--------	--------	1	--------	--------	--------
West Virginia	4	4	3	3	4	4	3	2
Wisconsin	1	1	1	--------	1	1	1	1
	65	54	43	39	71	55	45	40

TABLE 70.—*Benzol produced and sold in the United States in 1924, by States*

State	Produced (gallons)	Sold		
		Gallons	Value	
			Total	Average
Crude benzol:				
New York	1,830,814	1,839,376	$413,565	$0.225
Ohio	91,006	62,263	11,334	.182
Pennsylvania	1,368,339	1,413,504	291,781	.206
Alabama, Indiana, Missouri, West Virginia, and Wisconsin	566,749	545,265	114,739	.210
	3,856,908	3,860,408	831,419	.215
Refined benzol:				
Alabama	89,267	83,881	20,767	.248
Indiana	337,709	361,088	76,714	.212
New York	2,463,637	2,289,940	507,528	.222
Ohio	4,969,873	4,834,368	996,050	.206
Pennsylvania	3,228,653	3,226,541	690,474	.214
West Virginia	863,579	846,018	183,713	.217
Colorado, Illinois, Minnesota, Missouri, and Wisconsin	2,325,399	2,238,364	429,991	.192
	14,278,117	13,880,200	2,905,237	.209
Motor benzol:				
Alabama	10,760,423	10,591,810	1,587,603	.150
Colorado	1,200,523	1,198,285	(a)	(a)
Illinois	3,399,977	3,432,111	544,926	.159
Indiana	10,267,244	10,076,531	1,506,554	.150
Maryland	1,831,651	1,851,381	(a)	(a)
Minnesota	349,771	476,677	77,172	.162
New York	7,095,392	7,117,060	1,106,314	.155
Ohio	11,478,521	10,858,797	1,696,445	.156
Pennsylvania	22,887,745	23,195,406	3,437,348	.148
Tennessee	232,479	229,576	31,489	.137
West Virginia	2,179,486	2,133,011	341,272	.160
Michigan, Utah, and Wisconsin	2,085,599	1,760,579	276,448	.157
Undistributed	--------	--------	461,081	.151
	73,768,811	72,921,224	11,066,652	.152

[a] Included under "Undistributed."

Table 71.—*Toluol and solvent naphtha produced and sold in the United States in 1924, by States*

State	Toluol (crude and refined)[a]				Solvent naphtha			
	Produced (gallons)	Sold			Produced (gallons)	Sold		
		Gallons	Value			Gallons	Value	
			Total	Average			Total	Average
Alabama					751,980	477,306	$64,010	$0.134
Colorado	27,934	27,934	([b])	([b])	243,069	25,581	([b])	([b])
Illinois	883	10,154	$2,184	$0.215	([b])	([b])	([b])	([b])
Maryland					41,650	39,746	([b])	([b])
Minnesota					2,068	([b])	([b])	([b])
New York	1,092,425	1,095,154	277,504	.253	535,651	548,819	149,109	.272
Ohio	402,522	381,932	94,026	.246	762,999	625,284	136,332	.218
Pennsylvania	1,008,160	1,046,248	239,803	.229	1,462,569	1,506,411	253,584	.168
West Virginia	151,823	149,562	37,273	.249	275,122	258,025	49,803	.193
Indiana, Missouri, and Wisconsin	501,684	520,518	113,252	.218	363,025	364,732	59,318	.163
Undistributed			5,640	.202	36,087	38,681	12,718	.122
	3,185,431	3,231,502	769,682	.238	4,474,220	3,884,585	724,874	.187

[a] Mainly refined toluol.

[b] Included under "Undistributed."

Table 72.—*Crude light oil produced and sold at coke-oven plants in the United States in 1924, by States*

State	Produced (gallons)	Refined on the premises (gallons)	Sold		
			Gallons	Value	
				Total	Average
Alabama	17,231,508	14,188,858	522,480	$37,218	$0.071
Colorado	2,503,445	2,494,834			
Illinois	7,029,627	5,716,312	1,403,201	121,626	.087
Indiana	13,355,204	13,343,023			
Maryland	2,141,383	2,174,937			
Michigan	4,429,730	2,128,485	28,357	1,850	.065
Minnesota	712,753	712,753			
New York	6,752,970	16,945,871	310,965	28,743	.092
Ohio	27,154,392	22,417,702	4,209,151	345,872	.082
Pennsylvania	37,705,872	37,464,151	130,374	13,550	.104
Tennessee	299,739	296,670			
West Virginia	5,452,472	4,593,429	293,010	27,927	.095
Kentucky, Missouri, Utah, and Wisconsin	4,187,860	3,103,718	943,044	75,681	.080
	128,956,955	125,580,743	7,840,582	652,467	.083

COKE-OVEN GAS

TABLE 73.—*Disposition of gas from by-product coke ovens, 1915–1924, in per cent*

Year	Wasted	Burned in coking process	Surplus sold or used (not for ovens)	Year	Wasted	Burned in coking process	Surplus sold or used (not for ovens)
1915	3.2	57.3	39.5	1920	2.2	49.5	48.3
1916	4.0	58.4	37.6	1921	2.9	47.4	49.7
1917	5.4	55.7	38.9	1922	1.9	45.9	52.2
1918	4.1	54.8	41.1	1923	2.1	44.9	53.0
1919	2.6	51.0	46.4	1924	2.0	42.4	55.6

TABLE 74.—*Trend in prices of gas per M cubic feet, 1913–1924*

Year	Average price to householders[a]		Average value of all gas sold[b]		
	Manufactured gas (41 cities)	Natural gas (7 cities)	Natural gas[c]	Coal, oil, and water gas	Coke-oven surplus gas[d]
1913	$0.95	$0.37	$0.151	[e]$0.91	$0.088
1914	.93	.37	.159	(f)	.098
1915	.93	.38	.161	.91	.102
1916	.92	.38	.160	(f)	.098
1917	.91	.38	.179	.87	.087
1918	.95	.43	.213	.91	.087
1919	1.03	.49	.216	(f)	.086
1920	1.08	.49	.246	1.06	.140
1921	1.31	.53	.264	(f)	.168
1922	1.28	.57	.291	1.16	.167
1923	1.26	.58	.238	(f)	.162
1924	1.27	.60	.222	(f)	.165

[a] Computed from statistics of prices published by Bureau of Labor Statistics. See Monthly Labor Review, August, 1925. Average of prices in effect on or near Apr. 15. Further additions to prices in form of monthly service charge were made in this period.

[b] As reported by operators to the Bureau of Mines.

[c] Average value of all natural gas at point of consumption.

[d] Includes value of gas used by producer (not for ovens).

[e] Represents 1912.

[f] No report.

TABLE 75.—*Total production of gas fuel in the United States, 1913–1924*

[Does not include producer gas, blast-furnace gas, Pintsch gas, or acetylene]

Year	Quantity sold (billion cubic feet)				Rough equivalent in heating value (billion British thermal units)			
	1 Surplus coke-oven gas	2 Coal, oil, and water gas	3 Natural gas	4 Total	5 Surplus coke-oven gas (1×550)	6 Coal, oil, and water gas (2×575)	7 Natural gas (3×1,075)	8 Total (5+6+7)
Quantity								
1913	64	[a] 166	582	812	35, 200	95, 450	626, 000	756, 650
1914	61	174	592	827	33, 550	100, 050	636, 000	769, 600
1915	84	[a] 182	629	895	46, 200	104, 650	676, 000	826, 850
1916	110	196	753	1, 059	60, 500	112, 700	810, 000	983, 200
1917	131	[a] 211	795	1, 137	72, 050	121, 325	855, 000	1, 048, 375
1918	158	234	721	1, 113	86, 900	134, 550	775, 000	996, 450
1919	193	[a] 248	746	1, 187	106, 150	142, 600	802, 000	1, 050, 750
1920	230	262	798	1, 290	126, 500	150, 650	858, 000	1, 135, 150
1921	154	[b] 246	662	1, 062	84, 700	141, 450	712, 000	938, 150
1922	231	257	763	1, 251	127, 050	147, 775	820, 000	1, 094, 825
1923	318	[c] 260	[d] 1, 007	[d] 1, 585	174, 900	149, 500	1, 082, 000	1, 406, 400
1924	301	[c] 260	1, 142	1, 703	165, 550	149, 500	1, 227, 000	1, 542, 050
Per cent								
1913	7. 9	20. 5	71. 6	100. 0	4. 7	12. 6	82. 7	100. 0
1914	7. 4	21. 0	71. 6	100. 0	4. 4	13. 0	82. 6	100. 0
1915	9. 4	20. 3	70. 3	100. 0	5. 6	12. 6	81. 8	100. 0
1916	10. 4	18. 5	71. 1	100. 0	6. 2	11. 5	82. 3	100. 0
1917	11. 5	18. 6	69. 9	100. 0	6. 9	11. 6	81. 5	100. 0
1918	14. 2	21. 0	64. 8	100. 0	8. 7	13. 5	77. 8	100. 0
1919	16. 3	20. 9	62. 8	100. 0	10. 1	13. 6	76. 3	100. 0
1920	17. 8	20. 3	61. 9	100. 0	11. 1	13. 3	75. 6	100. 0
1921	14. 5	23. 2	62. 3	100. 0	9. 0	15. 1	75. 9	100. 0
1922	18. 5	20. 5	61. 0	100. 0	11. 6	13. 5	74. 9	100. 0
1923	20. 1	16. 4	63. 5	100. 0	12. 4	10. 6	77. 0	100. 0
1924	17. 7	15. 3	67. 0	100. 0	10. 7	9. 7	79. 6	100. 0

[a] Estimated by assuming a uniform rate of increase between successive years reported.

[b] Estimated from census reports, which show slight decrease as compared with 1919, although the census returns include some coke ovens.

[c] Estimated.

[d] Revised figures.

TABLE 76.—*Coke-oven gas produced and sold in United States in 1924, by States*

State	Number of plants	Produced (M cubic feet)	Used in process (M cubic feet)	Sold or used			Wasted (M cubic feet)
				M cubic feet	Value		
					Total	Average	
Alabama	7	71, 482, 260	33, 178, 103	36, 047, 580	$2, 486, 893	$0. 069	2, 256, 577
Colorado	1	8, 878, 126	3, 497, 908	5, 291, 038	([a])	([a])	89, 180
Illinois	6	37, 698, 090	15, 025, 470	22, 614, 984	5, 065, 083	. 224	57, 636
Indiana	6	62, 395, 379	29, 121, 159	31, 899, 861	7, 085, 838	. 222	1, 374, 359
Maryland	1	10, 784, 003	2, 585, 101	8, 198, 902	([a])	([a])	----------
Massachusetts	1	5, 795, 706	2, 601, 767	3, 193, 939	([a])	([a])	----------
Michigan	5	26, 057, 907	12, 230, 315	13, 789, 833	4, 527, 344	. 328	37, 759
Minnesota	3	8, 444, 039	4, 300, 794	3, 975, 214	1, 355, 824	. 341	168, 031
New Jersey	2	13, 942, 218	2, 567, 509	11, 374, 709	([a])	([a])	----------
New York	5	23, 098, 313	10, 416, 708	12, 390, 620	1, 989, 924	. 161	290, 985
Ohio	13	96, 033, 917	41, 786, 541	51, 688, 173	5, 966, 212	. 115	2, 559, 203
Pennsylvania	9	138, 625, 989	55, 643, 934	81, 435, 748	8, 793, 586	. 108	1, 546, 307
Tennessee	1	1, 342, 562	604, 153	604, 153	128, 794	. 213	134, 256
Utah	1	2, 045, 000	1, 124, 750	68, 360	([a])	([a])	851, 890
Washington	1	668, 930	----------	635, 952	844, 037	1. 327	32, 978
West Virginia	4	16, 689, 348	6, 999, 945	8, 600, 383	1, 245, 557	. 145	1, 089, 020
Kentucky, Missouri, Rhode Island, and Wisconsin	4	17, 119, 263	7, 614, 090	9, 394, 404	3, 522, 554	. 375	110, 769
Undistributed	------	----------	----------	----------	6, 773, 301	. 241	----------
	70	541, 101, 050	229, 298, 247	301, 203, 853	49, 784, 947	. 165	10, 598, 950

[a] Included under "Undistributed."

TABLE 77.—*Disposition of gas from by-product ovens in the United States, 1919–1924*

	Millions of cubic feet	Percentage of total production	Value	
			Total	Cents per M
1919				
For illuminating and household purposes	5,238	1.3	$2,106,806	40.2
For industrial purposes	138,121	33.2	8,078,442	5.8
To public service corporations	49,465	11.9	6,464,947	13.1
Total sold or used (not for ovens)	192,824	46.4	16,650,195	8.6
Used by producer or wasted	222,831	53.6		
Total produced	415,655	100.0		
1920				
Used under boilers	25,430	5.3	2,216,335	8.7
Used in steel or other related plants	151,765	31.8	14,301,095	9.4
Distributed through city mains, including sales to non-affiliated industries	53,221	11.2	15,716,888	29.5
Total sold or used (not for ovens)	230,416	48.3	32,234,318	14.0
Used in heating ovens	235,701	49.5		
Wasted	10,368	2.2		
Total produced	476,485	100.0		
1921				
Used under boilers	12,123	3.9	1,120,087	9.2
Used in steel or other related plants	98,352	31.7	10,593,204	10.8
Distributed through city mains, including sales to non-affiliated industries	43,826	14.1	14,249,961	32.5
Total sold or used (not for ovens)	154,301	49.7	25,963,252	16.8
Used in heating ovens	147,038	47.4		
Wasted	8,850	2.9		
Total produced	310,189	100.0		
1922				
Used under boilers	19,124	4.3	1,251,325	6.5
Used in steel or other related plants	144,976	32.7	15,942,446	11.0
Distributed through city mains	56,930	12.9	20,326,648	35.7
Sold for industrial purposes	10,353	2.3	1,104,901	10.7
Total sold or used (not for ovens)	231,383	52.2	38,625,320	16.7
Used in heating ovens	203,239	45.9		
Wasted	8,049	1.9		
Total produced	442,671	100.0		
1923				
Used under boilers	33,741	5.6	1,820,808	5.4
Used in steel or other related plants	200,099	33.3	22,646,134	11.3
Distributed through city mains	65,143	10.8	23,116,578	35.5
Sold for industrial purposes	19,459	3.3	4,025,700	20.7
Total sold or used (not for ovens)	318,442	53.0	51,609,220	16.2
Used in heating ovens	270,168	44.9		
Wasted	12,545	2.1		
Total produced	601,155	100.0		
1924				
Used under boilers	29,794	5.5	1,729,013	5.8
Used in steel or other related plants	187,172	34.6	21,007,607	11.2
Distributed through city mains	65,677	12.1	23,486,416	35.8
Sold for industrial purposes	18,561	3.4	3,561,911	19.2
Total sold or used (not for ovens)	301,204	55.6	49,784,947	16.5
Used in heating ovens	229,298	42.4		
Wasted	10,599	2.0		
Total produced	541,101	100.0		

TABLE 78.—*Use of by-product gas in the United States, 1923–24, by States*

State	Used under boilers			Used in steel or other affiliated plants			Distributed through city mains			Sold for industrial purposes		
	M cubic feet	Value		M cubic feet	Value		M cubic feet	Value		M cubic feet	Value	
		Total	Average		Total	Average		Total	Average		Total	Average
1923												
Alabama	11,840,554	$613,761	$0.052	18,157,713	$1,170,254	$0.064	1,436,320	$219,047	$0.153	3,065,890	$749,736	$0.245
Colorado				4,350,488	(a)	(a)						
Illinois	8,424,498	186,299	.022	8,716,990	1,115,567	.128	13,938,775	4,460,324	.320	1,476,892	292,235	.198
Indiana	1,585,969	141,451	.089	31,534,381	4,303,929	.136	4,733,404	2,862,427	.604	1,242,155	425,564	.343
Maryland				3,564,271	(a)	(a)	5,413,431	(a)	(a)			
Massachusetts							3,783,448	(a)	(a)			
Michigan	120	4	.033	3,772,437	1,131,731	.300	7,592,762	2,579,481	.340	21,030	5,531	.263
Minnesota	235,510	20,104	.085	1,633,105	209,605	.128	3,204,110	1,192,512	.372			
New Jersey							11,333,836	(a)	(a)			
New York	1,162,006	58,190	.050	9,714,394	638,949	.128	1,033,303	381,289	.369	1,022,977	892,382	.872
Ohio	5,297,645	523,859	.099	42,445,912	5,171,885	.122				8,671,268	764,923	.088
Pennsylvania	2,217,941	161,769	.073	72,652,785	7,817,586	.108	3,143,088	765,993	.244	199,991	21,322	.107
Tennessee	410,560	14,370	.035				486,102	150,359	.309			
Washington	4,872	4,039	.829				485,880	633,628	1.304			
West Virginia	207,454	12,217	.059	3,556,724	273,435	.077				3,148,138	848,455	.270
Kentucky, Missouri, Rhode Island, and Wisconsin	2,353,629	84,745	.036				8,559,056	3,365,640	.393	610,440	25,552	.042
Undistributed					813,193	.103		6,505,878	.317			
	33,740,758	1,820,808	.054	200,099,200	22,646,134	.113	65,143,515	23,116,578	.355	19,458,781	4,025,700	.207

[a] Included under "Undistributed."

TABLE 78.—*Use of by-product gas in the United States, 1923–24, by States*—Continued

State	Used under boilers			Used in steel or other affiliated plants			Distributed through city mains			Sold for industrial purposes		
	M cubic feet	Value		M cubic feet	Value		M cubic feet	Value		M cubic feet	Value	
		Total	Average		Total	Average		Total	Average		Total	Average
1924												
Alabama	14,835,325	$717,067	$0.048	16,446,973	$1,296,493	$0.079	1,640,923	$247,557	$0.151	3,124,359	$225,776	$0.072
Colorado				5,282,923	(a)	(a)				8,115	(a)	(a)
Illinois	4,889,365	126,926	.026	3,699,203	493,078	.133	12,596,469	4,122,479	.327	1,429,947	322,600	.226
Indiana	788,603	92,185	.117	24,809,210	3,675,044	.148	5,198,844	2,924,824	.563	1,103,204	393,785	.357
Maryland				3,260,767	(a)	(a)	4,938,135	(a)	(a)			
Massachusetts							3,193,939	(a)	(a)			
Michigan	2,202	677	.307	4,095,929	1,101,341	.269	9,448,412	3,255,383	.345	243,290	169,943	.699
Minnesota	57,092	6,510	.114	418,202	89,547	.214	3,499,920	1,259,767	.360			
New Jersey							11,374,709	(a)	(a)			
New York	1,964,498	121,758	.062	8,570,771	668,738	.078	978,564	321,971	.329	876,787	877,457	1.001
Ohio	4,210,052	487,429	.116	38,328,035	4,470,441	.117	846,000	296,100	.350	8,304,086	712,242	.086
Pennsylvania	1,373,541	112,735	.082	76,598,222	7,806,182	.102	3,453,395	873,866	.253	10,590	803	.076
Tennessee	103,464	3,621	.035				500,689	125,173	.250			
Utah							5,105	(a)	(a)	63,255	(a)	(a)
Washington	3,337	2,804	.840				632,615	841,233	1.330			
West Virginia	25,000	1,805	.072	5,661,648	457,044	.081				2,913,735	786,708	.270
Kentucky, Missouri, Rhode Island, and Wisconsin	1,541,567	55,496	.036				7,369,148	3,404,802	.462	483,689	62,256	.129
Undistributed					949,699	.111		5,813,261	.298		10,341	
	29,794,046	1,729,013	.058	187,171,883	21,007,607	.112	65,676,867	23,486,416	.358	18,561,057	3,561,911	.192

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[a] Included under "Undistributed."

TABLE 79.—*Yield and disposal of gas, and number of plants supplying gas for certain uses, 1923–24*

State	Yield of gas (M cubic feet) per ton of coal coked	Disposal (per cent of total)						Number of plants	
		In coke plants		To steel or other affiliated plants	For distribution through city mains	For industrial purposes	Wasted	Supplying gas for city distribution	Supplying gas to steel or other affiliated plants
		For use in heating coke ovens	For use under boilers						
1923									
Alabama	11.4	48.1	16.2	24.8	1.9	4.2	4.8	2	4
Colorado	11.2	40.4	--------	59.3	--------	--------	.3	--------	1
Illinois	11.2	35.6	16.4	16.9	27.2	2.9	1.0	4	2
Indiana	11.1	48.3	2.0	39.7	6.0	1.6	2.4	5	3
Maryland	10.9	29.5	--------	28.0	42.5	--------	--------	1	1
Massachusetts	10.0	52.5	--------	--------	47.5	--------	--------	1	--------
Michigan	10.6	53.1	--------	15.6	31.2	.1	--------	3	1
Minnesota	10.6	49.9	2.2	15.3	30.2	--------	2.4	2	1
New Jersey	11.4	18.0	--------	--------	82.0	--------	--------	2	--------
New York	11.0	54.7	4.0	33.8	3.6	3.6	.3	1	2
Ohio	11.4	44.2	5.0	40.2	--------	8.2	2.4	--------	8
Pennsylvania	10.9	44.9	1.5	49.7	2.2	.1	1.6	4	8
Tennessee	9.5	44.7	25.4	--------	29.9	--------	--------	1	--------
Washington	9.6	--------	.9	--------	92.8	--------	6.3	1	--------
West Virginia	10.8	47.0	1.3	23.5	--------	20.8	7.4	--------	2
Kentucky, Missouri, Rhode Island, and Wisconsin	10.8	48.0	10.5	--------	38.1	2.7	.7	3	--------
	11.1	44.9	5.6	33.3	10.8	3.3	2.1	30	33
1924									
Alabama	11.2	46.4	20.7	23.0	2.3	4.4	3.2	2	3
Colorado	11.8	39.4	--------	59.5	--------	.1	1.0	--------	1
Illinois	11.1	39.9	13.0	9.8	33.4	3.8	.1	5	2
Indiana	10.7	46.7	1.3	39.7	8.3	1.8	2.2	5	3
Maryland	9.8	24.0	--------	30.2	45.8	--------	--------	1	1
Massachusetts	10.1	44.9	--------	--------	55.1	--------	--------	1	--------
Michigan	10.8	46.9	--------	15.7	36.3	.9	.2	5	1
Minnesota	11.3	50.9	.7	4.9	41.5	--------	2.0	2	1
New Jersey	11.6	18.4	--------	--------	81.6	--------	--------	2	--------
New York	10.2	45.1	8.5	37.1	4.2	3.8	1.3	1	2
Ohio	11.4	43.5	4.4	39.9	.9	8.6	2.7	1	8
Pennsylvania	11.0	40.1	1.0	55.3	2.5	--------	1.1	4	8
Tennessee	13.0	45.0	7.7	--------	37.3	--------	10.0	1	--------
Washington	9.4	--------	.5	--------	94.6	--------	4.9	1	--------
West Virginia	11.2	42.0	.2	33.9	--------	17.4	6.5	--------	2
Kentucky, Missouri, Rhode Island, Utah, and Wisconsin	10.8	45.6	8.0	--------	38.5	2.9	5.0	4	--------
	11.0	42.4	5.5	34.6	12.1	3.4	2.0	35	32

NAPHTHALENE

TABLE 80.—*Total commercial production of naphthalene from all sources in the United States, 1918–1924*

[Total sales are shown for coke plants and gas works to avoid double counting in production of crude and refined]

	By-product coke ovens; sales of crude and refined	City gas works; sales of crude and refined	Tar distilleries and all other establishments	Total commercial production
Quantity (pounds):				
1918	15,890,447	896,080	40,138,092	56,924,619
1919	6,702,040	([a])	12,612,203	20,114,243
1920	14,448,762	1,760,293	26,393,411	42,602,466
1921	1,983,523	([a])	16,949,464	19,432,987
1922	4,887,935	([a])	19,323,393	25,411,328
1923	11,245,633	1,452,463	41,453,002	54,151,098
1924	8,219,073	([a])	34,683,803	44,102,876
Value:				
1918	$650,229	$14,282	$1,281,440	$1,945,951
1919	191,364	([a])	327,201	542,565
1920	487,974	63,449	791,403	1,342,826
1921	59,335	([a])	380,167	462,502
1922	131,252	([a])	352,957	536,209
1923	239,699	45,981	652,148	937,828
1924	128,208	([a])	441,333	602,541

	Imports of crude (free) [b]	Imports of refined (dutiable) [b]	Total imports [b]	Total produced and imported	Average spot price of flake in New York (cents per pound)
Quantity (pounds):					
1918	3,902,731	2,795	3,905,526	60,830,145	
1919	3,239,256	7,650	3,246,906	23,361,149	
1920	15,012,096	3,697,562	18,709,658	61,312,124	
1921	4,495,806	441,685	4,937,491	24,370,478	
1922	3,144,332	75,680	3,220,012	28,631,340	
1923	20,992,439	9,605	21,002,044	75,153,142	
1924	5,266,708	4,549	5,271,257	49,374,133	
Value:					
1918	$130,098	$171	$130,269	$2,076,220	9.95
1919	92,265	384	92,649	635,214	7.63
1920	530,219	416,172	946,391	2,289,217	12.68
1921	135,943	31,458	167,401	629,903	7.23
1922	54,029	7,684	61,713	597,922	6.15
1923	575,702	194	575,896	1,513,724	7.49
1924	96,491	1,147	97,638	700,179	5.36

[a] Data lacking or incomplete. Estimate included in total.
[b] Imports entered for consumption as reported by Tariff Commission.

TABLE 81.—*Naphthalene sold by by-product coke operators, 1916–1924*

Year	Quantity (pounds)			Value	Average receipts per pound (cents)		Receipts per ton of coke (cents)
	Crude	Refined	Total		Crude	Refined	
1916	([a])	([a])	8,820,405	$289,688	3.4		1.5
1917	([a])	([a])	17,276,044	569,449	3.3		2.5
1918	10,403,758	5,486,689	15,890,447	650,229	2.8	6.6	2.5
1919	4,038,455	2,663,585	6,702,040	191,364	2.0	4.1	.8
1920	11,507,703	2,941,059	14,448,762	487,974	2.7	6.1	1.6
1921	1,652,466	331,057	1,983,523	59,335	2.5	5.6	.3
1922	3,298,851	1,589,084	4,887,935	131,252	1.6	5.0	.5
1923	10,047,427	1,198,206	11,245,633	239,699	1.7	5.5	.6
1924	7,891,116	327,957	8,219,073	128,208	1.5	3.6	.4

[a] Not separately reported.

PRODUCTION OF COKE, 1880-1924, BY STATES

TABLE 82.—*Coke produced in the United States, 1880–1924, by States, in net tons*

Year	Alabama	Colorado	Georgia	Illinois	Indiana	Kansas	Kentucky	Maryland	Massachusetts	Michigan	Minnesota	Missouri	Montana	New Jersey	New Mexico
1880	60,781	25,568	38,041	12,700	----------	3,070	4,250	----------	----------	----------	----------	----------	----------	----------	----------
1881	109,033	48,587	41,376	14,800	----------	5,670	4,370	----------	----------	----------	----------	----------	----------	----------	----------
1882	152,940	102,105	46,602	11,400	----------	6,080	4,070	----------	----------	----------	----------	----------	----------	----------	1,000
1883	217,531	133,997	67,012	13,400	----------	8,430	5,025	----------	----------	----------	----------	----------	----------	----------	3,905
1884	244,009	115,719	79,268	13,095	----------	7,190	2,223	----------	----------	----------	----------	----------	75	----------	18,282
1885	301,180	131,960	70,669	10,350	----------	8,050	2,704	----------	----------	----------	----------	----------	175	----------	17,940
1886	375,054	142,797	82,680	8,103	6,124	12,493	4,528	----------	----------	----------	----------	----------	----------	----------	10,236
1887	325,020	170,698	79,241	9,198	17,658	14,950	14,565	----------	----------	----------	----------	2,970	7,200	----------	13,710
1888	508,511	179,682	83,721	7,410	11,956	14,831	23,150	----------	----------	----------	----------	2,600	12,000	----------	8,540
1889	1,030,510	187,638	94,727	11,583	8,301	13,910	13,021	----------	----------	----------	----------	5,275	14,043	----------	3,460
1890	1,072,942	245,756	102,233	5,000	6,013	12,311	12,343	----------	----------	----------	----------	6,136	14,427	----------	2,050
1891	1,282,496	277,074	103,057	5,200	3,798	14,174	33,777	----------	----------	----------	----------	6,872	29,009	----------	2,300
1892	1,501,571	[a] 373,229	81,807	3,170	3,207	9,132	36,123	----------	----------	----------	----------	7,299	34,557	----------	----------
1893	1,168,085	[a] 362,986	90,726	2,200	5,724	8,565	48,619	----------	----------	----------	----------	5,905	29,945	----------	5,803
1894	923,817	[a] 317,196	93,029	2,200	6,551	8,439	29,748	----------	----------	----------	----------	2,250	17,388	----------	6,529
1895	1,444,339	[a] 340,357	60,212	2,250	4,804	5,287	25,460	----------	----------	----------	----------	2,028	25,337	----------	14,663
1896	1,479,437	[a] 363,760	53,673	2,600	4,353	4,785	27,107	----------	----------	----------	----------	2,500	60,078	----------	24,228
1897	1,443,017	[a] 342,653	33,000	1,549	2,904	6,181	32,117	----------	----------	----------	----------	2,593	67,849	----------	1,438
1898	1,663,020	[a] 474,808	49,529	2,325	1,825	4,180	22,242	----------	----------	----------	----------	740	52,009	----------	6,980
1899	1,787,809	[a] 530,424	50,907	[b] 2,370	(b)	14,476	81,095	----------	(c)	----------	----------	2,860	56,376	----------	44,134
1900	2,110,837	[a] 618,755	73,928	(d)	(d)	5,948	95,532	----------	(d)	(d)	----------	2,087	54,731	----------	44,774
1901	2,148,911	[a] 671,303	54,550	(d)	(d)	7,138	100,285	----------	(d)	(d)	----------	4,749	57,004	----------	41,643
1902	2,552,246	[a] 1,003,393	82,064	(d)	(d)	20,902	126,879	----------	(d)	(d)	----------	5,780	53,463	----------	23,296
1903	2,693,497	[a] 1,053,840	85,546	(d)	(d)	14,194	115,362	(d)	(d)	(d)	----------	1,839	45,107	(d)	11,050
1904	2,340,219	[a] 789,060	75,812	4,439	(d)	9,460	64,112	(d)	(d)	(d)	(d)	2,446	41,497	(d)	58,259
1905	2,576,986	[a] 1,378,824	70,593	10,307	----------	4,425	79,487	(d)	(d)	(d)	(d)	1,580	31,482	(d)	89,638
1906	3,034,501	[a] 1,455,905	70,280	268,693	----------	1,698	74,064	(d)	(d)	(d)	(d)	----------	38,182	(d)	147,747
1907	3,021,794	[a] 1,421,579	74,934	372,697	----------	6,274	67,068	332,253	466,458	(d)	(d)	----------	40,714	256,057	265,125
1908	2,362,666	[a] 982,291	39,422	362,182	(d)	2,497	37,827	270,916	453,883	(d)	(d)	----------	(d)	248,893	274,565
1909	3,085,824	[a] 1,251,805	46,385	1,276,956	(d)	----------	46,371	315,587	444,349	(d)	(d)	----------	(d)	261,460	373,967
1910	3,249,027	[a] 1,346,211	43,814	1,514,504	(d)	(d)	53,857	335,373	450,001	(d)	(d)	----------	(d)	250,153	401,646
1911	2,761,521	[a] 1,177,023	37,553	1,610,212	(d)	(d)	66,099	343,451	477,564	(d)	(d)	----------	(d)	255,334	381,927
1912	2,975,489	972,941	43,158	1,764,944	2,616,339	(d)	191,555	304,715	511,596	(d)	(d)	----------	----------	304,715	413,906
1913	3,323,664	879,461	42,747	1,859,553	2,727,025	----------	317,084	236,423	531,384	(d)	(d)	----------	----------	255,792	467,945
1914	3,084,149	666,083	24,517	1,425,168	2,276,652	----------	443,959	87,852	540,631	(d)	(d)	----------	----------	255,283	362,572
1915	3,071,811	670,938	20,039	1,686,998	2,768,099	----------	526,097	313,283	504,438	(d)	127,847	(d)	----------	269,448	389,411
1916	4,298,417	1,053,553	47,127	2,320,400	3,489,660	----------	802,526	489,982	563,048	(d)	431,319	(d)	----------	210,766	502,812
1917	4,892,589	1,112,449	39,589	2,289,833	3,540,718	----------	863,071	518,810	595,113	(d)	490,272	(d)	----------	423,361	577,679
1918	4,352,172	989,447	22,048	2,285,610	3,898,215	----------	818,785	474,368	556,397	(d)	784,065	(d)	----------	682,148	597,072
1919	3,380,771	613,753	18,149	1,703,903	3,702,180	----------	691,969	356,237	393,331	808,729	586,094	(d)	----------	788,465	260,162
1920	4,013,891	789,499	16,523	2,136,793	4,553,697	----------	739,577	682,132	488,089	1,393,445	674,801	(d)	----------	725,571	(d)
1921	2,534,039	368,131	6,943	1,322,178	3,091,263	----------	284,825	292,439	294,059	777,125	435,866	(d)	----------	739,768	(d)
1922	3,799,865	484,039	8,832	1,982,906	3,995,505	----------	487,167	589,893	407,081	1,142,059	462,044	(d)	----------	790,811	87,631
1923	4,654,075	647,823	12,556	3,187,168	5,042,614	----------	559,711	861,668	554,125	1,648,773	695,824	(d)	----------	897,569	(d)
1924	4,541,058	735,520	8,081	2,355,474	4,272,435	----------	(d)	810,118	397,640	1,770,547	514,764	(d)	----------	869,120	83,070

[For footnotes see p. 662.]

TABLE 82.—*Coke produced in the United States, 1880–1924, by States, in net tons*—Continued

Year	New York	Ohio	Oklahoma (Indian Territory)	Pennsylvania	Rhode Island	Tennessee	Texas	Utah	Virginia	Washington	West Virginia	Wisconsin	Wyoming	Combined States	Total
1880	------	100,596	1,546	2,821,384	------	130,609	------	1,000	------	------	138,755	------	------	------	3,338,300
1881	------	119,469	1,768	3,437,708	------	143,853	------	------	------	------	187,126	------	------	------	4,113,760
1882	------	103,722	2,025	3,945,034	------	187,695	------	250	------	------	230,398	------	------	------	4,793,321
1883	------	87,834	2,573	4,438,464	------	203,691	------	------	25,340	------	257,519	------	------	------	5,464,721
1884	------	62,709	1,912	3,822,128	------	219,723	------	------	63,600	400	223,472	------	------	------	4,873,805
1885	------	39,416	3,584	3,991,805	------	218,842	------	------	49,139	311	260,571	------	------	------	5,106,696
1886	------	34,932	6,351	5,406,597	------	368,139	------	------	122,352	825	264,158	------	------	------	6,845,369
1887	------	93,004	10,060	5,832,849	------	396,979	------	------	166,947	14,625	442,031	------	------	------	7,611,705
1888	------	67,194	7,502	6,545,779	------	385,693	------	------	149,199	------	531,762	500	------	------	8,540,030
1889	------	75,124	6,639	7,659,055	------	359,710	------	761	146,528	3,841	607,880	16,016	------	------	10,258,022
1890	------	74,633	6,639	8,560,245	------	348,728	------	8,528	165,847	5,837	833,377	24,976	------	------	11,508,021
1891	------	38,718	9,464	6,954,846	------	364,318	------	7,949	167,516	6,000	1,009,051	34,387	2,682	------	10,352,688
1892	------	51,818	3,569	8,327,612	------	354,096	------	(a)	147,912	7,177	1,034,750	33,800	------	------	12,010,829
1893	12,850	22,436	7,135	6,229,051	------	265,777	------	(a)	125,092	6,731	1,062,076	14,958	2,916	------	9,477,580
1894	16,500	32,640	3,051	6,063,777	------	292,646	------	(a)	180,091	5,245	1,193,933	4,250	4,352	------	9,203,632
1895	18,521	29,050	5,175	9,404,215	------	396,790	286	(a)	244,738	15,129	1,285,206	4,972	4,895	------	13,333,714
1896	(c)	80,868	21,021	[e] 7,356,502	------	339,202	------	(a)	268,081	25,949	1,649,755	5,332	19,542	------	11,788,773
1897	(c)	95,087	30,364	[e] 8,966,924	------	368,769	394	(a)	354,067	26,189	1,472,666	17,216	24,007	------	13,288,984
1898	(c)	85,535	34,110	[f] 10,715,302	------	394,545	------	(a)	531,161	30,197	1,925,071	35,280	18,350	------	16,047,209
1899	(c)	83,878	24,339	13,577,870	------	435,308	------	(a)	618,707	30,372	2,278,577	33,437	15,630	------	19,668,569
1900	(d)	72,116	38,141	13,357,295	------	475,432	------	(a)	685,156	33,387	2,358,499	(d)	(d)	506,730	20,533,348
1901	(d)	108,774	37,374	14,355,917	------	404,017	------	(a)	907,130	49,197	2,283,700	(d)	(d)	564,191	21,795,883
1902	(d)	146,099	49,441	16,497,910	------	560,006	------	(a)	1,124,572	40,305	2,516,505	(d)	(d)	598,869	25,401,730
1903	(d)	143,913	49,818	15,650,932	------	546,875	------	(a)	1,176,439	45,623	2,707,818	(d)	(d)	932,428	25,274,281
1904	(d)	109,284	44,808	14,861,064	------	379,240	------	(a)	1,101,716	45,432	2,283,086	(d)	(d)	1,451,172	23,661,106
1905	(d)	277,130	54,781	20,573,736	------	468,092	------	(a)	1,499,481	53,137	3,400,593	(d)	(d)	1,660,857	32,231,129
1906	(d)	293,994	49,782	23,060,511	------	483,428	------	(a)	1,577,659	45,642	3,713,514	(d)	(d)	2,085,617	36,401,217
1907	385,478	270,634	19,089	26,513,214	------	467,499	------	(a)	1,545,280	52,028	4,112,896	(d)	------	1,088,493	40,779,564
1908	473,569	159,578	2,944	15,511,634	------	214,528	------	(a)	1,162,051	38,889	2,637,123	(d)	------	798,060	26,033,518
1909	523,551	222,711	(d)	24,905,525	------	261,808	------	(a)	1,347,478	42,981	3,943,948	(d)	------	964,359	39,315,065
1910	652,459	282,315	(d)	26,315,607	------	322,756	------	(a)	1,493,655	59,337	3,803,850	(d)	------	1,134,245	41,708,810
1911	686,172	311,382	------	21,923,935	------	330,418	------	(a)	910,411	40,180	2,291,049	(d)	------	1,947,258	35,551,489
1912	794,618	388,669	------	27,438,693	------	370,076	------	(d)	967,947	49,260	2,465,986	(d)	------	1,408,992	43,983,599
1913	758,486	351,846	------	28,753,444	------	364,578	------	(d)	1,303,603	76,221	2,472,752	(d)	------	1,577,522	46,299,530
1914	457,370	521,638	------	20,258,393	------	264,127	------	(d)	780,984	84,923	1,427,962	(d)	------	1,593,651	34,555,914
1915	684,461	684,658	------	25,622,862	------	256,973	------	(d)	629,807	136,552	1,391,446	(d)	------	1,825,982	41,581,150
1916	775,014	1,803,268	------	31,279,695	------	382,175	------	(g)	1,242,332	[g] 534,653	2,521,309	(d)	------	1,785,529	54,533,585
1917	993,184	3,694,302	------	27,912,025	------	411,326	------	(g)	1,304,230	[g] 497,533	3,349,761	(d)	------	2,100,983	55,606,828
1918	1,069,587	5,365,243	(d)	26,723,645	------	427,106	------	(d)	1,234,256	123,788	3,320,006	(d)	------	2,754,414	56,478,372
1919	751,067	5,481,660	(d)	20,501,831	(d)	260,915	------	(d)	930,516	62,546	1,413,932	(d)	------	1,474,347	44,180,557
1920	1,040,192	5,701,810	------	23,638,739	(d)	301,708	------	(d)	1,027,788	59,395	1,828,336	(d)	------	1,533,057	51,345,043
1921	746,916	3,028,423	------	9,769,476	(d)	85,728	------	(d)	280,476	27,260	397,892	(d)	------	804,815	25,287,622
1922	1,494,992	5,011,138	------	13,991,892	(d)	113,896	------	172,453	378,656	31,674	919,744	(d)	------	771,734	37,124,012
1923	1,783,948	6,473,606	(d)	25,624,286	(d)	304,511	------	232,941	774,887	69,068	1,762,775	(d)	------	1,189,606	56,977,534
1924	1,600,669	5,832,699	------	16,927,437	(d)	207,475	------	257,094	485,064	71,615	1,328,569	(d)	------	1,201,156	44,269,605

[a] Utah included with Colorado.
[b] Indiana included with Illinois.
[c] Included with Pennsylvania.
[d] Included under "Combined States."
[e] Includes New York.
[f] Includes Massachusetts and New York.
[g] Utah included with Washington.

THE MARKETING OF COAL PRODUCTS[4]

By R. S. McBride

FOREWORD

No other single commodity has the great industrial value of bituminous coal. Used directly as a fuel it supplies most industrial heat and power, and products made from it are essential to hundreds of industries. Few people realize how extensively the products made from coal are disseminated throughout industry and how complex are the interindustry relationships involved. This report on the marketing of coal products is intended to clarify the situation.

The report takes no stand in favor of producer, refiner, broker, or user. It tries rather to serve all by impartially stating the facts of to-day and the probable conditions of to-morrow as forecast by the recognizable industrial trends. It is published in the hope that it will aid all the various branches of domestic commerce in coal products.

In order to make the report as short as possible many important phases of the subject receive little or no attention. It is hoped that the advantage of giving a general perspective of the whole industry will much more than offset the disadvantage of any superficial treatment which brevity makes unavoidable.

Julius Klein, *Director*,
Bureau of Foreign and Domestic Commerce.

INTRODUCTION

IMPORTANCE OF PROBLEM

From 60,000,000 to 80,000,000 tons of bituminous coal are treated yearly in the coke ovens and gas works of the United States in the manufacture of coke, coal gas, tar, ammonia, light oils, and the other primary products of less importance. At the producers' plants these products have a value of $400,000,000 to $650,000,000 a year. Of the total quantity of products made the producer or his customers use by far the greater part as fuel in metallurgy, in industry, or for domestic heating and cooking; the remainder is further refined or manufactured into secondary products, materials of commerce, such as tar products, fertilizer, and chemicals.

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[4] This study was originally prepared for the domestic commerce division of the Bureau of Foreign and Domestic Commerce, under the supervision of A. Heath Onthank, chief of the domestic commerce division. The study relates to the conditions existing at the end of 1924, when it was written.

As the various coal products are marketed in crude or refined form, they pass from industry to industry; the finished product of one stage becomes the raw material of the next. Thus these products render an economic service and acquire a value far above that represented by their market price at the original point of production. In fact, these materials serve, perhaps, more than any other single group of commodities, to tie industries together and necessitate the intricate interindustry relationships of to-day. Their marketing is therefore of great importance to producer, industrial user, and the general public.

Unfortunately a large proportion of the coal products made is still used for inferior economic service. For example, about half the coal tar produced is burned as a fuel instead of being separated into its valuable constituents, some of which should certainly be used for superior purposes. There are still wide fluctuations in the prices of these products and consequent losses to producers or users. Much of this condition is unavoidable at present, but part at least can be corrected by better understanding of the technical and economic facts. In an average year the industries involved take $300,000,000 worth of bituminous coal and make from it primary products worth at least $500,000,000; these products, in turn, could be further processed to be worth fully a billion dollars annually were the demand sufficient to absorb the derivatives. However, before this result can be realized for the benefit of industry and the public there must be further study of technical possibilities, better balancing of supplies and demands for the numerous products, and a closer interindustry cooperation than has yet been attained.

It is clearly recognized that such improvements can come but gradually, mainly by evolution from within the industry rather than by any revolution or pressure from without. The time when all the coal will be coked and no raw coal will be burned is far in the distant future. This report does not undertake to forecast the means or the date of this transformation, but rather to outline the fundamental technical, economic, and business principles of the industry clearly enough to aid the advances that can reasonably be expected within the next few years. The author hopes that this treatment of the subject will inspire only those visions of the future that are practicable and that it may aid profitable as well as ambitious expansion of the industries concerned.

SCOPE OF REPORT

Obviously this report can deal with only the most important phases of the problems of marketing and does not in any sense attempt to describe selling methods that are or should be used, such as advertising, sales campaigns, or organization of sales forces; it seeks, rather, to explain where the various coal products are used, how and why they are so used, what prevents wider use in such fields, how higher values may be realized, and what requirements the products must meet to command these higher values.

Managers of coal-gas works are commonly occupied with problems of public relations; those of coke works are kept busy meeting the demands for uniform high-quality coke at low cost. The writer hopes that this report will help both groups to coordinate their particular problems with those of the many other users of coal products.

Moreover, the text is addressed as much to the owner, dealer, broker, and salesman as to the technical man who serves as manager, superintendent, engineer, or chemist of the plant. Each group will find here much that is old, for no claim of novelty is made for any part of this report. The author has endeavored, however, to assemble in one place a general outline of the industrial problems of marketing coal products. To complete this outline would require several treatises, each many times larger than this report. The reader, therefore, must look elsewhere for complete and specialized technical treatment of the various parts of the subject.

ACKNOWLEDGMENTS

The author gratefully acknowledges the assistance of H. A. Curtis, F. G. Tryon, O. P. Hood, and F. W. Sperr, in the criticism and revision of this report; thanks are also due the several members of the staff of the Bureau of Foreign and Domestic Commerce who aided in the coordination of this work with the work of the chemical, mineral, and domestic commerce divisions of the bureau. Virtually all of the statistics employed have been gathered by the coal division of the Bureau of Mines, under the direction of F. G. Tryon. These data have given an invaluable statistical basis for much of the discussion.

PROCESSING OF COAL

FIVE PRIMARY PRODUCTS

The processing of bituminous coal is commonly spoken of as carbonization or coking. It consists, essentially, in driving from the coal those constituents that are volatile when decomposed at elevated temperatures. The treatment is carried out in a refractory chamber in the absence of air, or, in the beehive oven, with the admission of very small quantities of air.

Sixty-five to seventy-five per cent of the weight of the coal charged into the oven remains, after treatment, as a solid in the oven or retort and is called coke. The rest of the original weight of the coal is driven off by the heat and is represented by gases or by the vapors of the liquid products. As it cools the crude mixture of gas and vapor deposits first the heavier of its liquid constituents as tar. Upon further cooling and washing with water or with sulphuric acid the gas gives up the water vapor and the gaseous ammonia that it contains, forming either an ammonia solution in water or the chemical compound ammonium sulphate. The gas is finally washed with an oil that removes the vapors of benzol, toluol, and other similar chemical compounds, which are called "light oils." There remains then only the gas, which is commonly used for heating or is sold for city distribution. Some incidental products are at times made and recovered from the primary operations, but commonly only the five products named above need be considered as primary products of coking—coke, gas, tar, ammonia, and light oil.

TYPES OF CARBONIZING PLANTS

Of the four general types of equipment used for coal processing the oldest type is the beehive coke oven. The retort type of coking equipment is the next oldest and is still extensively used in gas works. In fact, the term "gas works," where used in this report, is intended to include only such plants as use retorts (either horizontal, inclined, or vertical) or the related slot type of coking equipment. The by-product oven ranks third in age and at present is the most important type. The fourth type of equipment is used for treating coal at temperatures below those used in the three preceding types and hence is known as "low-temperature carbonization" equipment. This report, however, does not deal with low-temperature processes and products, for they have not yet become commercially important in the United States.

In some plants the main object is the manufacture of coke; in other plants gas is the most important product. Hence, one might classify all coal-processing plants as coke plants or gas plants, according to the chief objective of operation. Such classification, however, is not convenient statistically nor is it desirable for a marketing study such as this. Some plants operating primarily for gas production have equipment identical with that at coke plants, therefore the products of operation of both are substantially the same and enter the markets in direct competition. This is true because the heat treatment given the coal and the products, or what may be called their "thermal history," determines the character of the products quite as much as the kind of coal from which they have been made. For our purposes it is better, therefore, to group together the products from the same kind of coal-processing equipment and to disregard altogether the question of whether coke or gas is the chief product desired.

BEEHIVE COKE OVENS

The coal treated in beehive ovens is heated by being partly burned. None of the gaseous products driven off during heating are saved; all of them are an economic loss. This waste in beehive-oven coking is so well recognized that it needs no further discussion here. The reader should note, however, that the beehive oven has rendered and still does render one great economic service—namely, the maintenance of stand-by coke-making capacity with very small investment. Thus, the waste of raw material is, in part, offset by the conservation of capital invested.

The coke produced in the beehive oven has only 60 to 65 per cent of the heating value of the coal treated, whereas the by-product oven saves at least 85 per cent. Perhaps for this reason more than any other few if any new beehive ovens will be built in the United States in the future. A large number still in existence and presumably in condition to operate when needed will doubtless never again be employed. They do afford, however, an available reserve of coke-making capacity when market demand is active—a reserve that is of substantial value to the country as a whole.

Coke made in beehive ovens is of large size, strong, and very well suited to metallurgical use where resistance to crushing is important. For this reason blast-furnace and foundry men formerly purchased beehive coke as the only acceptable metallurgical fuel; in fact, virtually all beehive coke has been sold for blast-furnace, foundry, or other metallurgical purposes. It is now well recognized, however, that beehive coke is no better than by-product oven coke unless the beehive coke is made from a better quality of coal.

BY-PRODUCT COKE OVENS

The by-product coke oven has largely replaced the beehive oven, and virtually all ovens built in the future will be of the by-product type. The capital invested in a by-product oven plant is large; such a plant can not be shut down and started up again at will without danger of serious damage to the refractories that form the oven structure; for both these reasons the manufacture of the chief product of the by-product oven plant must be virtually continuous. The output can be changed somewhat by varying the rate of heating; but in striking contrast with the beehive oven, the by-product oven plant is almost never idle after it once begins operation.

Under usual market conditions the value of the coke produced is about equal to that of the coal used in making it. The sale of the by-products, including gas, must carry most of the operating expense, interest, depreciation, repairs, and profit to owners. Thus, the products of carbonization, which go to waste in the beehive oven, repay not only the cost of their recovery but also the operating expense of making the coke and the profit to the investor whose money has built the plant.

RETORT GAS WORKS

Some of the chief products made from coal in any gas retort are the same, in a general way, as those made in the coke oven; but the markets open to the cokes and the relative quantities of the products to be sold are quite different.

The retort type of plant is used only in works supplying gas for public-utility distribution. Compared with the total sales of coal products the output of retort plants in the United States is relatively small. Some of their products are distinct in character, but most of them affect marketing methods or market values obtained by the coke industry. Hence, these products deserve and receive careful though brief consideration in this report.

LOW-TEMPERATURE CARBONIZATION

The coking of coal at low temperatures has been tried with some technical success in a number of plants. None of these plants, however, is in commercial operation at present except on an experimental scale. The products of low-temperature coking are a semicoke—which usually must be briquetted or otherwise further treated before use—an oil-like tar, a very rich gas, and relatively small amounts of light oil and ammonium sulphate. The sale of this tar and of the rich gas demands the consideration of wholly new problems, because their chemical properties are distinctly different from those of the analogous products of high-temperature coking. Hence one of the important problems in further development of the low-temperature branch of the industry will be determination of the best ways to use these new products. As yet no real marketing problem is involved in this branch of the business because the production is small; for this reason these products will not be discussed further in this report.

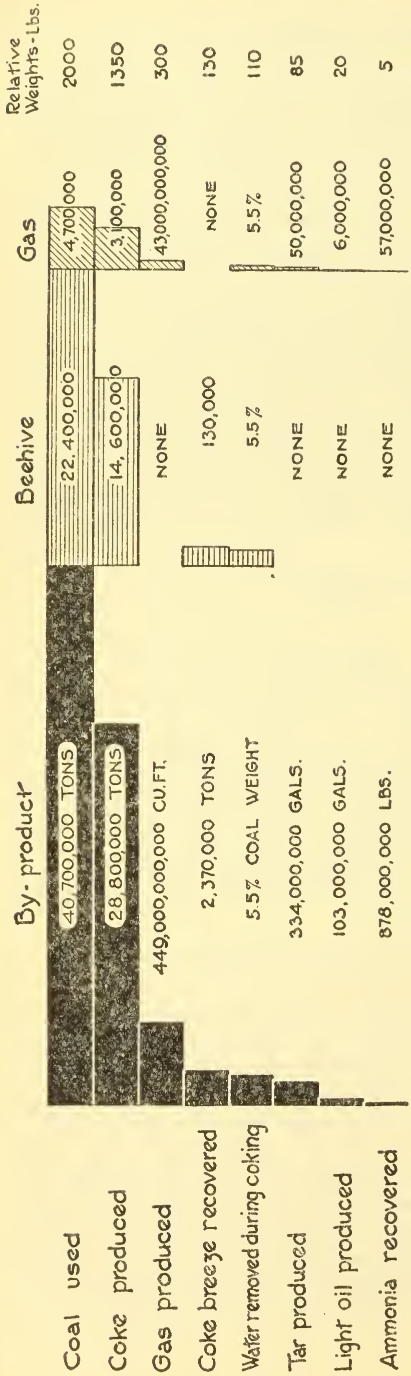

FIGURE 18.—Annual production at coke and gas works. The figures represent the average amounts for 1919 to 1923, inclusive

QUANTITY OF COAL PRODUCTS MADE

Figures 18 and 19 show graphically the average quantities and values of the coal products made in the United States annually during the five-year period 1919 to 1923. These charts make clear the relative weights and market values of the products from each of the three coking systems—by-product ovens, beehive ovens, and coal-gas retorts. The data on which these charts and most of the subsequent tables and charts are based are those gathered by the United States Geological Survey and the Bureau of Mines.

INTERRELATION OF COAL-PRODUCTS INDUSTRIES

FUELS AND RAW MATERIALS

It is evident from the most cursory consideration of the coal-products business that coke and gas works sell to the ultimate user almost nothing but fuels. Coke goes to the blast furnace or foundry; gas is sold to industrial plants or to householders for heating and cooking; tar is often sold for use as fuel. But when these or other products of carbonization are used except as fuel they usually become raw materials for manufacture of other products, which in turn are sold once or many times before reaching the ultimate user.

Thus the coke-oven or gas-works sales manager should be regarded as a distributer of raw materials for chemical processes as well as a manufacturer of fuels.

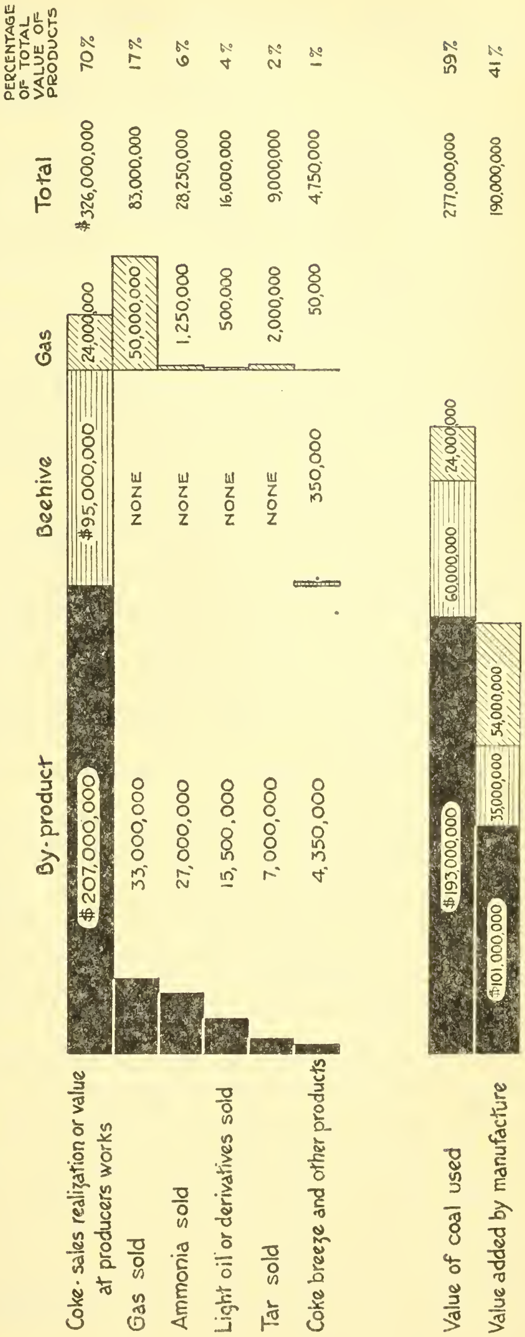

FIGURE 19.—Annual value of coke and gas works products. The figures represent the average for 1919 to 1923, inclusive

As a consequence the relationships with other industries are many and complex; sometimes they involve intraindustry disposal, sometimes interindustry sales of the products. A complete industrial "family tree" of these relationships need not be attempted here, but a condensed summary is important. This is given in Figure 20. From it one can see the relation of sales outlets at high unit prices to those where very low prices prevail.

IMPOSSIBILITY OF SELECTIVE MANUFACTURE

The production of one coal product is almost invariably accompanied by production of all the others. Under these circumstances the importance of properly balanced demands for coke, gas, tar, and other products is even greater than is generally recognized. However, the simultaneous production of the primary coal products does not mean that they will always be made in exactly the same proportions, one to the other. Selection of coal and modification of operating methods permit wide changes in the ratio, for example, of gas to coke, or coke to light oil; but economic as well as engineering and chemical considerations prevent the extreme application of this idea. The operating scheme which, under any particular plant condition, yields the most profit is, of course, the one that will be selected.

COMPETING PRODUCTS

There is hardly one of the products of coal carbonization that does not compete industrially with other materials. Coke is a competitor of anthracite for water-gas making and for domestic fuel. Tar as a fuel must compete with fuel oil, powdered coal, and ordinary bituminous coal and must show a real advantage to the user if it is to replace them.

Gas and electricity are competitors in the industrial field as well as in household cooking and heating; but coal gas and water gas compete even more keenly for preference when plans for a plant to make city gas are being prepared. Light oil is used mainly for motor fuel, and its price is fixed by direct comparison with the price of gasoline. Ammonia, as ammonium sulphate, is sold for fertilizer use; its price depends largely upon the availability and price of other suitable nitrogen-bearing plant foods.

The special competitive features of each of these products will be taken up in subsequent sections of this report. For the present it is enough to emphasize the fact that the prices of competing commodities indirectly fix the prices of coal products in many of their chief applications. Thus, the manager who wishes to increase his sales realization should look to special use for those products for which the higher price can be expected. Only in such special fields is the active competition of wholly different commodities not feasible.

INTERRELATION OF PRICES OF COAL PRODUCTS

The margin of profit in most manufacturing businesses is limited only by competition; but under the present system of regulation of public utilities the profit margin of a gas company is limited by the rates fixed by the regulating authority. Hence, a gas company is asked to subtract from its gross expenditures the net income from the sale of coke, tar, ammonia, and other so-called by-products of gas making. The resulting "net cost" of the gas is then used by the public authorities as one item in fixing the price the public is to be charged for gas.

Under such regulation an increase in income from sales of tar, for example, means a lowering of gas rates, or a slack market for coke may make gas prices higher. The gas user thus becomes quite as much concerned, though he may not know it, in the markets for tar, coke, and other coal products as in the market for gas.

In the plant operated primarily to make coke for blast-furnace use a somewhat similar relation exists, especially where the coke and furnace departments are under a common ownership or management. The amount the company charges against the furnace department for coke depends upon the credits the company receives for tar, light oil, ammonium sulphate, and also gas, which is a by-product in this plant.

At least to some degree the user of any one coal product has to pay for losses occurring in the sale of other products that are made

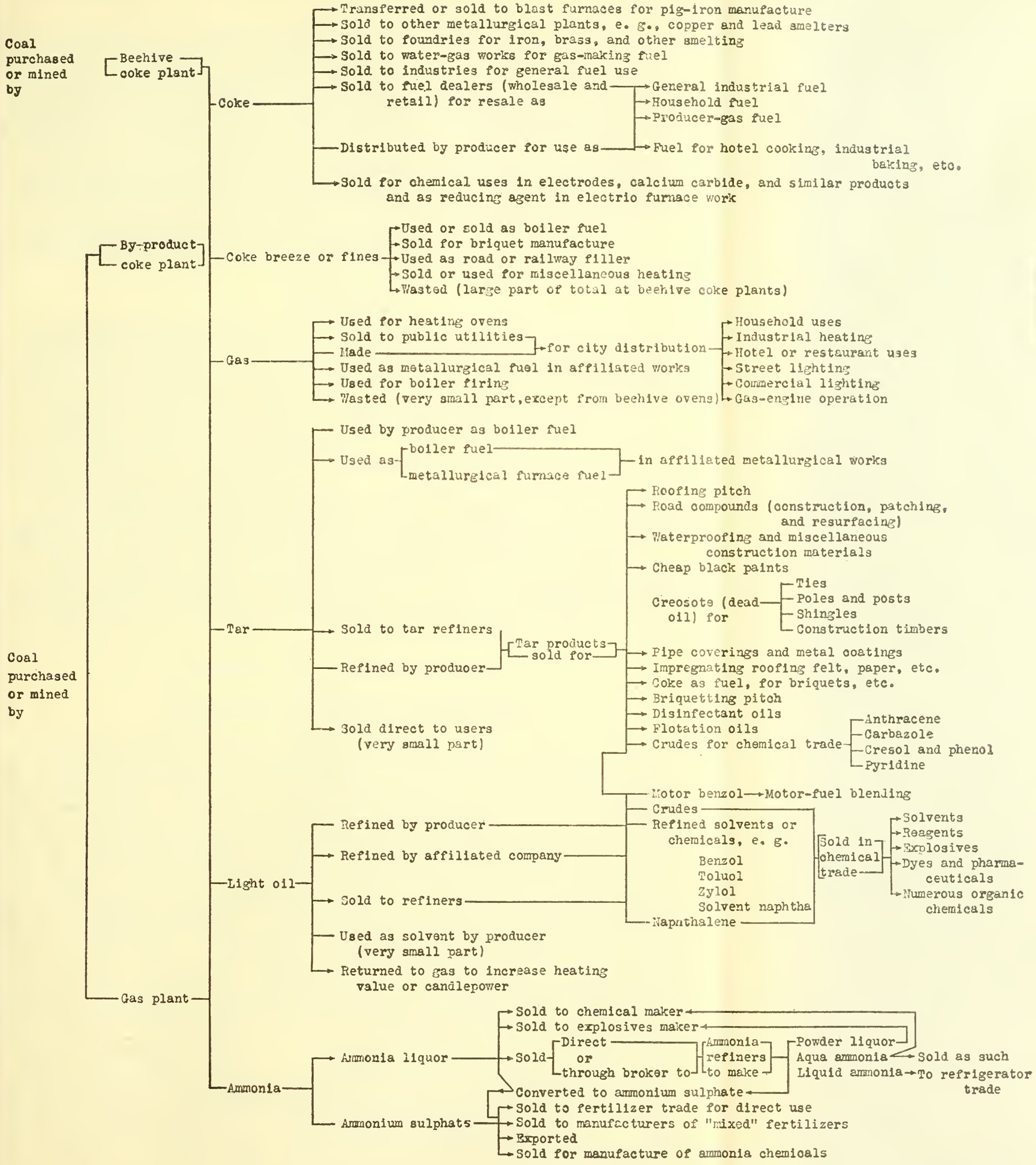
Coal purchased or mined by
Beehive coke plant
By-product coke plant
Gas plant
Coal purchased or mined by
Coke
Transferred or sold to blast furnaces for pig-iron manufacture
Sold to other metallurgical plants, e. g., copper and lead smelters
Sold to foundries for iron, brass, and other smelting
Sold to water-gas works for gas-making fuel
Sold to industries for general fuel use
Sold to fuel dealers (wholesale and retail) for resale as
General industrial fuel
Household fuel
Producer-gas fuel
Distributed by producer for use as
Fuel for hotel cooking, industrial baking, etc.
Sold for chemical uses in electrodes, calcium carbide, and similar products and as reducing agent in electric furnace work
Coke breeze or fines
Used or sold as boiler fuel
Sold for briquet manufacture
Used as road or railway filler
Sold or used for miscellaneous heating
Wasted (large part of total at beehive coke plants)
Gas
Used for heating ovens
Sold to public utilities
Made
for city distribution
Used as metallurgical fuel in affiliated works
Used for boiler firing
Wasted (very small part, except from beehive ovens)
Household uses
Industrial heating
Hotel or restaurant uses
Street lighting
Commercial lighting
Gas-engine operation
Tar
Used by producer as boiler fuel
Used as
boiler fuel
metallurgical furnace fuel
in affiliated metallurgical works
Sold to tar refiners
Refined by producer
Tar products sold for
Sold direct to users (very small part)
Roofing pitch
Road compounds (construction, patching, and resurfacing)
Waterproofing and miscellaneous construction materials
Cheap black paints
Creosote (dead oil) for
Ties
Poles and posts
Shingles
Construction timbers
Pipe coverings and metal coatings
Impregnating roofing felt, paper, etc.
Coke as fuel, for briquets, etc.
Briquetting pitch
Disinfectant oils
Flotation oils
Crudes for chemical trade
Anthracene
Carbazole
Cresol and phenol
Pyridine
Light oil
Refined by producer
Refined by affiliated company
Sold to refiners
Used as solvent by producer (very small part)
Returned to gas to increase heating value or candlepower
Motor benzol
Motor-fuel blending
Crudes
Refined solvents or chemicals, e. g.
Benzol
Toluol
Zylol
Solvent naphtha
Napthalene
Sold in chemical trade
Solvents
Reagents
Explosives
Dyes and pharmaceuticals
Numerous organic chemicals
Ammonia
Ammonia liquor
Ammonium sulphate
Sold to chemical maker
Sold to explosives maker
Sold
Direct or through broker to
Ammonia refiners to make
Powder liquor
Aqua ammonia
Liquid ammonia
Sold as such
To refrigerator trade
Converted to ammonium sulphate
Sold to fertilizer trade for direct use
Sold to manufacturers of "mixed" fertilizers
Exported
Sold for manufacture of ammonia chemicals

FIGURE 20.—The interindustry flow of coal products. Each arrow indicates a sale or interindustry transfer of one of the more important primary or secondary products; the chart does not show chemical, pharmaceutical, or other ultimate products derived from these primary or secondary products of carbonization

[illegible]

simultaneously. This is in striking contrast with the price fluctuations resulting from increase or decrease in cost of coal, or of money for plant investments, or from changes in wage rates, which tend usually to advance the price of all products together or to reduce all together, according to the fluctuations of cost of production. The charges for raw material, labor, and capital can not be accurately apportioned among the various products, so the effect of variations in these charges can not be exactly uniform for all products. But the over-all income must, of course, exceed over-all outgo if the business is to remain solvent; this can be assured only when all products contribute in fair proportion to the income account.

SUMMARY

The generalizations under this section about the processing of coal must clearly be borne in mind in the study of the subsequent discussion of the problems of marketing each coal product. The problems may be summarized as follows:

1. Many coal products now used as fuels will eventually be applied to greater economic service.
2. Advance to such desirable ends can come only as properly balanced markets are developed.
3. A coking plant must usually run continuously, even though demand for its products is poor; when operating it must produce all of the primary products regardless of available markets.
4. The market prices of all these products are intimately interrelated among themselves, but the price of each is largely governed by the market for wholly different products with which it must compete.

SALE AND USE OF COKE

CHANGES IN MARKET CONDITIONS

From two-thirds to three-fourths of the weight of coal charged into a by-product oven or gas retort is removed in the form of coke. In value, also, coke is by far the most important of the products of coal processing. Coke is, of course, the only product of the beehive oven; its sale or book value is about 65 per cent of the total value of the products produced in the by-product coke oven; and in the coal-gas works it represents the most valuable product except gas. From these facts one would suppose that the marketing of coke had been thoroughly studied and had become a rather routine problem for the industry. The reverse is true, however, except at those coke-oven plants which are built by metallurgical companies to supply coke for use in their own blast furnaces. There, of course, no problem of marketing is involved; it is simply a matter of bookkeeping, crediting the coke department and charging the furnace department for the coke transferred.

The constantly changing conditions in both coal-gas and coke-oven industries probably account for the unsettled state of the methods of marketing coke. For over 30 years by-product coke has been gradually replacing beehive coke, a change which has been very rapid in recent years. Coke has also been competing directly with anthracite, both for water-gas manufacture and for a variety of industrial heating operations, and lately as a domestic fuel. The changing character of the equipment used for making coal gas for city supply has also been a factor largely influencing the available supplies of coal, the prices, and the necessary marketing methods in the coke business.

TABLE 83.—*Production of metallurgical and gas-house coke in the United States, 1880–1924*

Year	Beehive coke		By-product coke		Gas-retort coke		Total (including estimates)	
	Million net tons	Value, millions of dollars	Million net tons	Value, millions of dollars	Million net tons produced	Value (of sales only), millions of dollars	Million net tons	Value, millions of dollars
1880	3.3	6.6			(a)	(a)	(a)	(a)
1885	5.1	7.6			(a)	(a)	(a)	(a)
1890	11.5	23.2			(a)	(a)	(a)	(a)
1893	9.5	(a)	0.013	(a)	(b)	(a)	11.0	(a)
1900	19.5	44.8	1.1	2.6	(b)	(b)	22.1	50.4
1905	28.8	61.6	3.5	10.9	2.3	[c] 4.0	34.6	76.5
1910	34.6	74.9	7.1	24.8	(b)	(b)	44.0	103.7
1911	27.7	56.8	7.8	27.3	(b)	(b)	37.8	88.1
1912	32.9	69.2	11.1	42.6	[c] 2.4	5.8	46.4	117.6
1913	33.6	80.3	12.7	48.6	(b)	(b)	48.6	134.8
1914	23.3	50.3	11.2	38.1	(b)	(b)	37.3	94.8
1915	27.5	56.9	14.1	48.6	2.9	7.2	44.5	112.7
1916	35.5	95.5	19.1	75.4	(b)	(b)	57.4	178.3
1917	33.2	159.6	22.4	138.6	3.1	11.0	58.7	309.2
1918	30.5	189.3	26.0	193.0	3.2	14.0	59.7	396.3
1919	19.0	98.1	25.1	160.2	(b)	(b)	47.3	272.3
1920	20.5	163.0	30.8	313.0	3.1	11.6	54.4	487.6
1921	5.5	30.2	19.7	117.5	(b)	(b)	28.2	158.6
1922	8.6	50.0	28.6	188.3	2.9	12.0	40.1	250.3
1923	19.4	115.9	37.6	257.6	(b)	(b)	60.0	385.5
1924	10.3	48.4	34.0	195.7	(b)	(b)	47.3	256.1

[a] Data not available. [b] No report; estimate included in total. [c] Estimated.

KINDS AND QUANTITIES OF COKE AVAILABLE

The history of coke production in the United States can be most quickly grasped by studying the data in Table 83. In these data, as in the subsequent discussion, a sharp distinction must be made between the coke from beehive ovens, that from by-product ovens, and that made in coal-gas retorts. The availability and the price of each kind of coke has a large influence upon the price of the other kinds; but these three classes of coke are not always strictly competitive, for they are not wholly interchangeable. Both gas-works and by-product coke are used for water-gas manufacture and as domestic fuel, and both by-product and beehive coke are used for blast-furnace fuel. Direct substitution, however, often is not possible, and even in the two instances named some modification in methods of operation is usually necessary if another kind of coke is made.

In general, one may say that beehive coke is sold almost exclusively as a metallurgical fuel, mainly for iron blast furnaces, but also extensively for the smelting of other metals and for foundries. Speaking also in general terms, one can say that retort gas-works coke is used almost exclusively for water-gas manufacture, for industrial heating, and as a domestic fuel in place of anthracite or bituminous coal. By-product oven coke, on the other hand, is used for all of these purposes and so at one point or another is a competitor of both.

An exact summary of the uses of coke in the United States can not be made from the available data, but Figure 21 shows graphically the distribution of coke as nearly as it can be estimated. This chart gives in a simple way a general idea of the quantities of each kind of coke that go to each of the principal consuming industries or groups, and the approximate money value of the coke thus sold or used.

Those who study this chart should understand that the bookkeeping value of the coke is often used instead of the actual market or sale value. This may give a somewhat distorted picture of the actual facts, because in a steel company, for example, the bookkeeping value of the coke transferred from one department to another is often very much lower than that which the company would for a minute consider an appropriate sale price. Hence, the coke that moves from one department to another of metallurgical concerns does not appear as prominently in the chart of values as it should in comparison

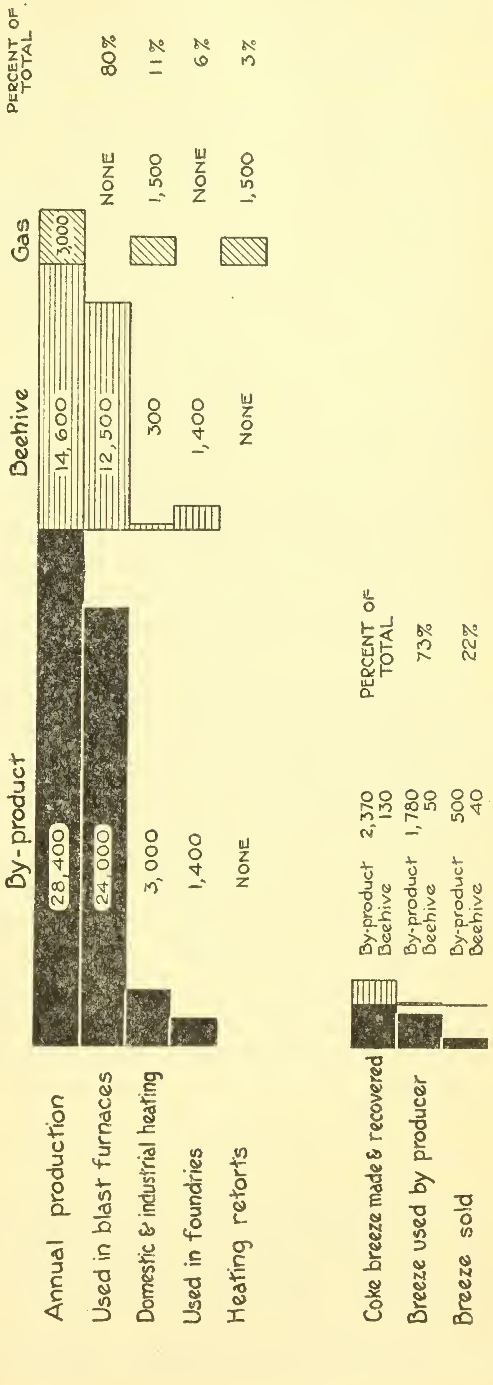

FIGURE 21.—Estimated uses of coke in the United States. The figures represent thousand net tons

with the coke sold by one corporation to another. This point will be discussed in greater detail in the section on the use of coke in metallurgy.

RELATION OF COKE AND STEEL INDUSTRIES

For more than 10 years more than 70 per cent of the by-product coke produced in the United States has been manufactured at plants directly connected with iron or steel companies; and each year about 80 per cent of the coke produced is used as blast-furnace fuel. Table 11, page 604, and Figure 22 summarize this situation very well. Even a larger percentage of the beehive coke ovens has been owned and operated in this way by metallurgical companies. In fact, one might almost say that the beehive coke business is altogether a subsidiary of the steel and nonferrous metal industries.

It is obvious that the blast-furnace operator must have a dependable supply of coke. Nothing is so fatal to blast-furnace success as an irregular supply of raw material or fuel; and irregularity in coke supply, because of either poor quality or inadequate quantity, is intolerable. For these reasons alone a steel company is likely to prefer to own and operate the ovens that make most of the coke it needs. Furthermore, the cost of coke is one of the largest single factors in the cost of pig iron. Hence, maximum economy in manufacturing coke is essential if pig iron is to be sold profitably in a competitive market. There is no reason why a metallurgical concern using large quantities of coke can not operate a battery of coke ovens as efficiently as an independent company, and by eliminating the profits of coke manufacture from the cost of coke, the ultimate price of pig iron can be substantially reduced. All of these factors have contributed to the establishment of the intimate relation now existing between the coke and the steel industries.

The coke used by the producer company for metallurgy is, of course, not marketed, but its availability largely affects the markets for other coke. Moreover, the by-products made at the metallurgical coke works compete with by-products made in other plants. This is true in part because few metallurgical concerns, even of large size, depend solely upon their own coke production for furnace fuel; yet some such companies market a part of the coke which they make, particularly in slack periods of the steel business. Not infrequently, therefore, the metallurgical company is a purchaser of coke during the periods of peak business and a seller of coke in slack times. As might be expected, these operations add materially to the fluctuations of coke supply and to the problems of price adjustment throughout the coke industry.

CHANGED RELATIONS OF BEEHIVE AND BY-PRODUCT COKE

In considering marketing conditions and present relationships between coke and steel industries, one must recognize the fact that a very important change has taken place during the years since the World War. This is the change in the relative production of beehive and by-product coke. The dominant position assumed by the by-product industry radically changes the market not only for the coke itself but also for gas, tar, and other by-products as well.

Formerly beehive coke was the backbone of blast-furnace fuel supply. Certain quantities of by-product coke were used, and some furnaces operated exclusively on this fuel. But, in general, by-product coke plants were regarded by the steel man as only a minor part of the total capacity for production of his fuel supply. The by-product plants affiliated with iron furnaces did, indeed, operate steadily; but of the product of the nonfurnace plants, which were formerly relatively more important, only so much was sold for blast-furnace use as current deficits of beehive coke demanded or as lower prices made expedient. The rest of the by-product coke was sold elsewhere.

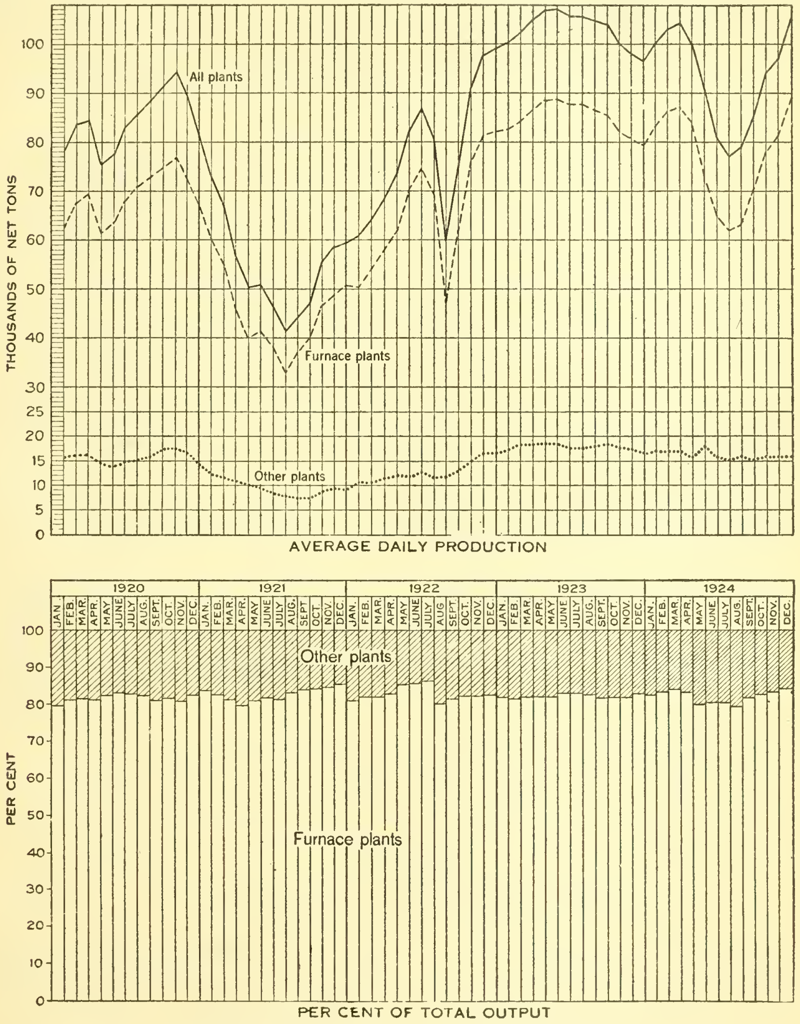

FIGURE 22.—Fluctuation in coke-plant activity

Present conditions are exactly the reverse. Far more by-product coke than beehive coke is used in pig-iron manufacture, and the price of by-product coke is regularly higher. It has become the regular and the chief furnace fuel. Changes in demand for furnace fuel are now met almost altogether by changing the rates of production of beehive coke. Thus, the beehive branch of the business assumes the rôle of a balance wheel.

Figure 23 shows the coal consumed in the manufacture of beehive and by-product coke.

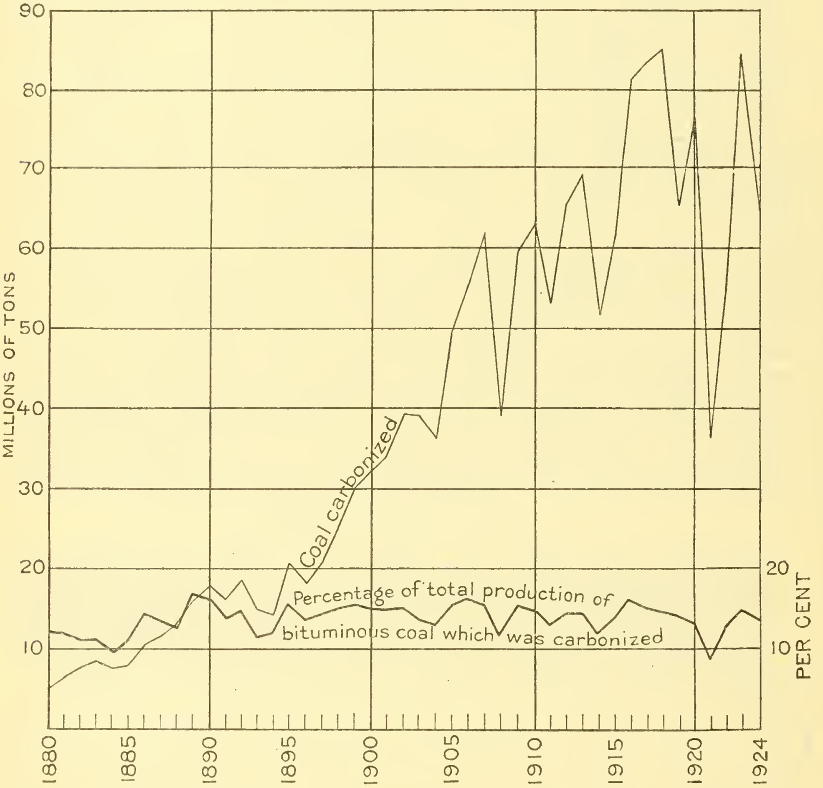

FIGURE 23.—Coal consumed in the manufacture of beehive and by-product coke, 1880–1924

COKE USERS ALSO COKE SELLERS

At every time of depression in the steel industry some of the metallurgical companies owning coke works are likely to become sellers of coke, thus reversing their normal relation to the market. In this respect there is a very great difference between the integration in the packing industries, for example, and that in the steel business. In times of slack demand for meat products the packer simply buys less livestock. He is not compelled to go on buying and handling livestock for which he has no immediate need. The steel man, however, who has a coke plant in operation can not readily shut this down, and hence he may choose to go on producing this one of his principal raw materials despite the slack times.

Under these circumstances there is a great temptation to place upon the market metallurgical coke which is probably well suited to the needs of blast furnaces, but not so well adapted to the needs of other large users. Often the result is to create an unfavorable impression impossible to eradicate from the mind of the disappointed coke user. Moreover, of course, the spot market for coke breaks badly and the contract market sags, often to an alarming degree from the viewpoint of the operator of a merchant coke plant.

MARKET REQUIREMENTS OF BLAST-FURNACE AND FOUNDRY COKE

Metallurgical coke is of two general kinds, according to the use made of it, known in the markets as "foundry" or "furnace" coke. Formerly the requirements for both of these fuels gave much more attention to size of pieces and to general appearance than to those chemical or physical characteristics that can be accurately defined. Now well-established methods of testing are used by various companies, but there is not as yet any general agreement among buyers as to a specification covering the determinable properties of cokes.

The coke plant that operates primarily for manufacture of blast-furnace fuel must strive first of all for a uniform product, since uniformity of coke is a prime requisite at the blast furnace. The quality of the coal from which the coke is made determines the ash, sulphur, and phosphorus content of the product, and to some extent affects the physical properties such as apparent and true specific gravity, porosity, resistance to shatter, and that rather intangible property known as "cell structure." However, the method and rate of coke formation, which are fixed by the coke-oven practice, also largely affect these physical properties.

In general, a coke of a uniform and not too small size, and reasonably resistant to breakage on handling and under load in the furnace, can successfully be sold for blast-furnace use, although such a coke requires that the blast-furnace methods be carefully adapted to the behavior of the fuel; also, some cokes are more conveniently and efficiently used in certain furnaces than are others. These facts lead to some well-grounded preferences for and to many unfounded prejudices against coke made from certain coals or by certain oven plants. In fact, the selection of coke by purchasers is more largely influenced by personal judgment, based upon real or claimed experience, than by any well-established scientific principles or tests. Because of this habit of purchasers a coke producer must of necessity establish and maintain a favorable market reputation in the iron industry.

PROPERTIES OF FOUNDRY COKE

In coke marketed for foundry use a low percentage of sulphur, phosphorus, and ash is often more important than in coke for blast-furnace use; for foundry use coke of relatively large size and dense structure with heavy cell walls is required. This coke must have the greatest possible strength or toughness for resisting shock and attrition, because in the cupola the coke is subjected to the most severe treatment.

In a by-product oven the manufacture of high-grade foundry coke is facilitated by using coal mixtures containing a larger percentage of low-volatile coal of the Pocahontas or New River smokeless type. This low-volatile coal is considerably more expensive in many localities, which accounts, in part at least, for the greater cost and higher market price of foundry coke.

From the above discussion it is obvious that coke made in gas works can under no circumstances enter the metallurgical market; it is far too irregular in quality, too friable, and too high in volatile matter. Gas-house coke is therefore used exclusively for domestic and industrial fuel.

PREPARATION OF METALLURGICAL COKE FOR MARKET

The preparation of metallurgical coke consists only of screening. It is customary to sell as furnace coke all pieces which will pass over a screen with openings ¾ inch to 1¼ inches. The exact limit of size is determined partly by the demands of the furnace operator and partly by economic conditions, particularly the market for domestic sizes. Thus, if there is a good market for domestic coke there is no objection to diverting more to that market, and a screen with 1¼-inch openings would be used. On the other hand, if domestic coke sells with difficulty, the oven operator puts as much of the small coke into "furnace" size as the furnace man will take.

For foundry coke it is usual to take only the coke that will pass over 2½-inch openings. The smaller size, as in the screening of the furnace coke, is subsequently divided into domestic coke and "fines" or coke "breeze."

Commonly it is not the practice to make both furnace coke and foundry coke in the same ovens at the same time, though this can be done by taking the largest coke for foundry use, the large intermediate size for furnace use, and the smaller size for domestic and miscellaneous purposes. If the same ovens are used, however, there must be a compromise in coke quality between the ideal for furnace and the ideal for foundry use. It is therefore considered better practice periodically to modify the coal mixture or the conditions of oven operation so that furnace coke will be made on some days or in some parts of the plant and foundry coke on other days or in other parts of the plant. The small-size coke from the two systems of operation is usually mixed for domestic and industrial sale.

COKE FOR HOUSEHOLD FUEL

Coke used as a household fuel affords one of the best available substitutes for anthracite coal. When properly prepared, coke can be successfully used by the householder as an economical, smokeless fuel and a substitute for bituminous coal so widely used in house heating, especially in the Middle West, West, and South. However because of irregularity in the supply and the inferior quality of coke occasionally dumped on the household-fuel market, coke has acquired an unfortunate reputation in many places. As the further development of all parts of the coke industry demands the establishment of a stable market for household coke it is very important that any source of difficulty be eliminated and bad reputation acquired locally in the past be overcome. The further rapid development of city gas manufactured from coal also depends more upon the establishment of profitable coke markets than on any other single factor. This problem, therefore, is one of equal concern to the gas industry and the coke industry.

The householder can use with general satisfaction the small coke that is separated from the large coke in the process of making blast furnace or foundry fuel if it is properly screened by sizes. Hence, the domestic fuel market offers suitable and permanent outlet for the small-size coke that the metallurgical industry itself can not well utilize. But the maker of metallurgical coke can not expect to derive benefit from this domestic fuel market unless he is willing to give some thought and regular service to maintenance of proper supplies of domestic coke. For example, he can not hope to have the domestic-fuel customers continue as his regular patrons if at times of coke shortage, when all fuels are usually above the average in price, he cuts off the coke supply to that market.

Because of this fact some students of the coke industry have maintained that it is utterly impossible for any company consistently to meet both the fluctuating demands of metallurgy and the regular demand of the domestic fuel consumers. Such persons would have us believe that the merchant coke plant, which is interested primarily in supplying household fuel, is the only establishment that can regularly care for that market. Doubtless there is some truth in this conclusion, but the difficulty has probably been exaggerated somewhat by the unusual extremes of activity and depression in the coke-oven industry during the five years immediately following the World War.

QUALITY OF DOMESTIC COKE

The sizes of coke offered for household use vary from city to city, according to local custom. In general the sizes are known as egg, stove, nut, pea, and breeze, roughly corresponding to the usual anthracite sizes of the same names. Sometimes the largest domestic size is known as furnace coke, but it should not be confused with the blast-furnace coke of metallurgy, as it is smaller on the average. Often the name " furnace " means the size more commonly called " egg." Ultimately coke sizes will doutbless be standardized on approximately the basis now used for anthracite coal.

In screening coke for domestic and miscellaneous industrial uses care should be exercised to maintain uniformity of size in each group. Coke of the smaller sizes, especially the breeze, contains more ash and is thus more likely to form clinker. It is very important wholly to eliminate the breeze, to take unusual precautions against breakage or " degradation " in size, and to market a coke that contains ash of low fusing point. Nut or stove sizes can be used successfully alone for many purposes, but if they are mixed indiscriminately with larger or egg-size coke the mixture is not as satisfactory as either size alone, because it packs in the fire box. For this reason coke should be as carefully sized as is anthracite. It is, however, often advantageous to the consumer to purchase a large-size and a small-size coke and to store them separately in his cellar, so that he can vary the charge in his furnace to suit the state of the weather.

Coke is distinctly more bulky than either anthracite or bituminous coal; hence, larger space for bin storage and a larger fuel box in the furnace are desirable. Some of the difficulties encountered in marketing coke for domestic heating have resulted from attempts to use the larger sizes in furnaces that were too small. In such heating plants it is often impossible to get enough coke into the furnace to retain a proper fire throughout the night in extremely cold weather. Obviously, under such conditions coke should not be used alone but should be replaced or supplemented with a suitable size of anthracite, or other dense fuel, which can be used both to bank the fire at night and for regular operation in extremely cold weather.

Use of cokes with ash of low melting point has also caused difficulty in establishing a permanent domestic fuel market. Practically the only solution of this difficulty is to make the coke from a different coal. Coke with ash of low melting point can not be burned without some clinkering, even with skilled firing of the furnace and the greatest care, and exercise of this care regularly is rather too much to expect of the average householder. To make coke from a coal with ash of high melting point would probably be less expensive than the necessary educational effort to teach the householder how to use coke made from coal inferior with ash of lower melting point. Certainly this is one of the problems which the industry has not yet solved to the entire satisfaction of the householder.

The chemical characteristics of coke are commonly of little concern to the domestic user unless extremely high-ash coal has been employed. Occasionally, however, coke manufacturers have dumped on the domestic market cokes containing excessive percentages of sulphur. This sulphur produced corrosive products of combustion which were highly objectionable, largely because of their odor. In consequence the reputation of coke as domestic fuel suffered severely in the localities where such coke was sold.

The behavior of coke in a furnace depends to a considerable extent upon " combustibility." This property can not be accurately defined, but the presence of some residual volatile matter in the coke tends to facilitate ignition and free burning. Much of the difficulty householders have in using beehive or foundry cokes is probably due to the fact that these types are overcoked; they contain substantially no residual volatile material and are structurally of a form rather hard to ignite and keep afire. Insofar as it is practicable, therefore, the manufacturer of coke for household use seeks to leave some volatile matter in the coke and to produce a cell structure that gives better ignition and freer burning.

NEED OF EXPANDED HOUSEHOLD COKE MARKETS

If a by-product oven or gas works is to establish a permanent market for coke as a domestic fuel, it must do a great deal of educational work in addition to observing the various precautions described above. Moreover, the educational effort usually must continue over a period of many years, for householders are loath to change the type of fuel that they use.

In districts where anthracite is the common household fuel the main inducement usually offered by coke is lower price. Many new customers can be induced to take coke in place of hard coal if the price is a dollar or two less per ton; but often an assurance of instruction in the use of coke is also needed. Such instruction is important to the new coke user, for coke usually requires a distinctly different system of furnace or stove operation from that used with anthracite. Some companies have even gone so far as to offer to put a ton of coke in the customer's basement and teach him how to use this fuel for his particular heating plant, guaranteeing that if it does not give full satisfaction there will be no charge and the unused coke will be removed. But even with such inducements it has not always been easy to effect extensive substitution.

In the communities where coal gas has been made for many years the local company has often been able to build up a very satisfactory market for surplus coke. Such companies often strive to sell all of the year's estimated coke output within a short period early in the summer, arranging for delivery and billing throughout the summer, fall, or winter, as may suit the customer's convenience. One such concern, which has had very great success in its coke sales, is able each year to dispose of its expected coke production within a few days, either direct to the customer or by arrangement with local fuel dealers. In this plant the coke is screened to proper size and is delivered, either by the gas company itself or by a fuel dealer, at approximately the same rate as it is made. Thus, no large stock of coke need be kept at the gas works. This advantage is great, not only because it saves storage space and prevents tying up money in the coke pile, but because it also saves much of the degradation caused by extra handling into and out of the stock pile and by exposure during bad weather. These advantages are enough to justify the acceptance of a lower price by the gas company than would otherwise be fair; and thereby the customer, gaining a better price for coke, is encouraged to cooperate with the company by placing his order for the year's supply at the time of the summer selling campaign.

THE DEALER PROBLEM

Wholesale and retail fuel merchants logically should be the distributers of the surplus coke from ovens connected with metallurgical plants as well as of the coke made at merchant ovens. The retailer, however, has been particularly loath to assume the new problems and responsibilities of handling coke.

Coke occupies much more room in storage and in the delivery trucks. It must be handled with much more care than anthracite to avoid excessive breakage of the pieces. Moreover, like all new commodities, it meets a decided sales resistance. Dealers, therefore, expect a larger margin of profit for handling a ton of coke than is necessary in handling a ton of anthracite. Often the retailer expects a margin as much as $3 or more per ton of coke, and with this figure some dealers claim that they do not make as much profit as is necessary.

If a dealer undertakes to sell coke for household use in times when anthracite is plentiful he must also undertake an educational campaign among his patrons. This usually necessitates an inspection of the heating plant where the coke is to be burned and some consultation with or actual instruction of the householder in firing the new fuel. Under these circumstances the development of a dealer organization has been decidedly slow in most parts of the country.

COKE FOR WATER-GAS MAKING

An important use of coke is in the manufacture of water gas, for which purpose coke competes directly with anthracite. The choice between the two fuels is largely a question of relative prices; there are slight advantages for each. Distinctly different operating practice is needed in the water-gas plant according to the fuel used, but in the last analysis, the difference in convenience and in capacity of gas-making equipment is usually a minor factor in the choice between the two fuels. The major factor is the relative cost of coke per thousand cubic feet of water gas produced.

In gas works where both coal gas and water gas are made, the solid fuel generally used for the water gas is the coke produced in making coal gas. Thus, by an intraplant transaction, many combination plants solve at once the problem of the disposal of coal-gas coke and of the supply of water-gas fuel. However, the majority of water-gas works are not affiliated with coal-gas works; at these water-gas plants the selection of coke, as well as the choice between coke or anthracite, is a matter for local determination. The by-product oven or the coal-gas manager who wishes to sell coke for use in such a plant must depend for its sale upon the price per ton and the water-gas operating efficiency which can be attained with the coke that he supplies.

Coke for water-gas manufacture should contain as low a percentage of ash as possible, and this ash must be of medium or high fusing point. A higher percentage of ash and particularly a low fusing point of ash are objectionable because of the increased frequency at which the water-gas machine must be stopped for clinkering and for ash removal and the extra time required for each cleaning operation when the coke is poor. A coke that adds one-half hour per shift to the clinkering time reduces by just this much the gas-making capacity of the machine. In water-gas making—as in most other industrial operations—capital charges, labor expense, and overhead are just about the same day by day, regardless of the output. As a consequence, 10 per cent reduction in the output means almost 10 per cent increase in unit cost for each item, and a coke that causes such delay is decidedly handicapped in this market.

INDUSTRIAL USES OF COKE

Numerous miscellaneous uses of coke have been developed locally by managers of gas works. In the field of nonferrous metallurgy there are many coke users. Coke is also commonly employed for making producer gas and for firing industrial furnaces where a smokeless fuel is desired. Properly prepared and sized coke gives an excellent fire, easily controlled, from which a large amount of heat can be radiated. Thus, it lends itself to operations, such as baking or roasting, where radiant heat is particularly desired.

These miscellaneous uses can not well be classified nor is it possible accurately to estimate the quantity of coke they require. The general methods of marketing in this field are, however, so common and well recognized as to need no further consideration here. Moreover, the requirements for each process or for each plant are rather specialized, so that each use becomes a problem in itself. With the increasing cost of anthracite and the wider availability of coke these industrial uses are bound to increase. They will, however, generally be stimulated only when the prospective user receives from the coke-oven or gas-works company as much attention and assistance in his fuel problem as does the metallurgical company which uses large amounts of coke or the industry which uses a great quantity of gas. In other words, real sales engineering will be required.

IMPORTS AND EXPORTS OF COKE

Only relatively small quantities of coke are exported from the United States, and virtually none is imported. During a few years the annual exports have exceeded 1,000,000 tons, but usually the total is between 400,000 and 1,000,000 tons. The imports are limited almost altogether to small quantities brought in from Canada for users near the Canadian border; usually the total tonnage so handled is only 30,000 to 50,000 tons a year, a natural consequence of the relatively low value per unit of weight and of the availability of coke in many places throughout the world.

GENERAL MARKETING METHODS

In marketing coke the usual selling schemes are employed. It is not necessary to discuss these in this report, for they involve no methods that are not in general use for merchandising in other industries. Similarly, it is unnecessary to discuss at any length the relation of the spot and contract markets for either beehive or by-product coke, for the relation between the spot and contract prices is as usual for commodities that show decided fluctuations in production and demand. Changes in price almost always appear first in the spot market, whether the trend be up or down, and the range in spot-market prices is usually greater than in the contract market.

Most of the metallurgical coke that is actually bought and sold for blast-furnace use is handled by direct negotiation between representatives of the producing and consuming companies. There are, however, a limited number of brokers and wholesalers who deal extensively in furnace coke, particularly in beehive coke. As has been pointed out above, most of the coke used in blast furnaces is not sold but is simply transferred from the coke department to the blast-furnace department of the same concern.

The marketing of coke for foundry use, for manufacture of water gas, and for general industrial purposes is accomplished by a wide variety of selling methods. Dealers, brokers, and salesmen of the producing companies are all engaged in selling coke for these uses. In localities near the producing plant domestic sizes of coke are marketed to some extent directly by a selling organization of the producing company; but more commonly wholesalers and retailers who handle other fuels take coke from the producing company and handle it in the domestic trade as they do anthracite.

Coke from gas works is often marketed by the gas companies' own sales forces, although frequently a gas works arranges with local fuel dealers to carry gas-house coke. This coke, in contrast with that from by-product ovens, usually will not stand railway shipment, both because of the narrow margin of profit afforded dealers and because the coke is structurally not strong enough to stand the extra handling involved in loading and unloading for rail as well as for local haul.

CONNELLSVILLE COKE AS PRICE BASE

In the earlier years of the industry the price of Connellsville (Pa.) beehive coke was used as a basis for sales made elsewhere. This practice originated during the period when Connellsville supplied the bulk of the beehive coke used in metallurgy and has continued despite the fact that the Connellsville district now sells less than a fourth of the country's total.

Originally, prices in many communities represented the Connellsville price plus the freight differential to the point of sale. To some extent this is still true, but now the Connellsville price is largely determined by the market prices which can be obtained elsewhere. The Connellsville price is what the local producer can get in the markets still open to him, less the freight rates from Connellsville. Hence, the business conditions in other districts really fix coke prices, but as Connellsville is still the chief source of reserve supply to supplement by-product coke and still ships widely even in times of normal market the differential between prices in different districts is more or less based upon freight differentials with respect to Connellsville.

"MERCHANT" OVEN PLANTS

The establishing of merchant by-product oven plants is still in the early stages of development. Such plants engage in the general sale of coke, the supply of gas for industrial or public utility distribution, and the marketing of other coal products. As they are not directly connected with either the metallurgical or public utility corporations, these companies take on the aspect of a complicated manufacturing enterprise to a greater extent than do any other coal-processing plants. Such companies usually have their own traveling salesmen and also cooperate with fuel wholesalers and retail distributers of coal in the important cities in their vicinity. In fact, such a plant to command the best possible return for coke generally finds it necessary to use all such selling methods simultaneously.

Gaining the cordial cooperation of the coal merchants is particularly important to these plants. Otherwise the reasonably prompt development of markets for household fuel can not be achieved. The active support of retailers is especially helpful in districts where anthracite is the common household fuel. In territories where bituminous coal is very cheap and is generally used for household heating, it is much more difficult to introduce coke because the price per ton is greater, and the advantage of smokeless fuel does not appeal strongly to the householder when his neighbors' chimneys are all belching smoke. Nevertheless, even in such territory coke has made marked progress.

COKE BREEZE

In all coke-making processes an appreciable percentage of the coke produced is much too fine for use in ordinary heating operations. These fines, or "breeze" as they are commonly called, are separated from the coke in screening out the various commercial sizes. The problem is to dispose of them to the best advantage.

In the beehive branch of the industry one may say that the problem of disposal is still unsolved. In fact, it is doubtful whether in an average year more than one-tenth of the fine coke made in such plants is sold. Usually, therefore, the beehive-coke breeze is treated as a waste product and allowed to accumulate in dumps much like the anthracite culm banks of Pennsylvania. In general, the cost of selling and delivery to a market is greater than the price that can be obtained.

No accurate figures on the quantity of breeze produced in the manufacture of beehive coke are available, but the quantity is estimated by various authorities at 3 to 10 per cent of the total marketable coke produced. In 1921 the United States Geological Survey made inquiry of all beehive-coke producers as to the uses made of this breeze. Only 69 operators replied out of a total of 303 plants. In all probability it can be safely assumed that most of those who did not reply are making no use of the breeze produced. A summary of the replies received by the Survey shows the following uses of the breeze and the number of plants reporting each use:

Disposal—	Plants
Dumped or otherwise wasted	38
Used for railroad fills	2
Used for road material	3
Used under boilers	9
Used at brick plant	1
Used in sintering plant	2
Stocked at ovens, awaiting better market	4
Sales, purpose not stated	10
	69

USE OF BREEZE AT BY-PRODUCT PLANTS

Breeze coke makes a fairly satisfactory boiler fuel if the boiler plant is designed for it. However, the material is worth relatively so little per ton that generally it must be used at the producer's plant or near by, for it will not justify shipment to a distance.

A majority of the by-product oven plants in the United States report that they use most of the breeze they produce, generally as boiler fuel. In 1921, probably a typical year, approximately 80 per cent of the breeze manufactured at such plants was so employed, and only a little over 10 per cent was sold. Most of the rest was reported that year as added to stock, and only 1.1 per cent was reported as wasted.

During the past few years a new heating system for by-product ovens has been developed which promises material advantage in the use of breeze. Instead of using some of the oven coal gas itself to heat the ovens this system employs producer gas manufactured for the purpose. This makes the entire production of coal gas available for other use or sale. It also provides an immediate use for nearly all of the breeze produced at the oven plant, for breeze and some of the other small coke is used in the gas producer. In this heating scheme any small amount of breeze left over would usually be employed for steam raising in fuel-fired boilers; none would remain to be sold. This would be particularly true in the by-product plant recovering light oil, since a light-oil plant demands an amount of steam which can not be supplied by the waste-heat boilers of the gas-producer plant alone.

In rare instances by-product oven breeze is used for other domestic or industrial purposes than that of boiler fuel. It is, however, higher in ash content than the larger coke and so much more difficult to burn without clinkering that it rarely makes an acceptable household fuel; only in an exceptional case would this breeze be the best industrial fuel when both cost and service value were considered.

It has often been proposed that breeze be marketed in the form of briquets, but at the present time no commercial plant is making them. The operation of such a plant would involve one serious technical difficulty—namely, the great wear upon mixing and briquetting equipment through the abrasiveness of the coke. In fact, handling breeze coke is always somewhat more difficult than handling other similar materials, because the pieces are very hard and rapidly wear all the surfaces over which they pass.

COKE FREIGHT RATES

One ton of coal makes only two-thirds ton of coke, but the volume of this coke is practically the same as that of the original coal; hence the shipment of a given tonnage of coke requires either larger cars or a larger number of cars than the same tonnage of coal. As a result of this and of the higher unit value of the coke freight rates on coke have always been distinctly higher per ton than on coal.

Originally, coke freight rates were based upon production of the coke in beehive ovens only. Now that most of the coke is made in by-product ovens located rather at points of consumption than at the coal mine, there is considerable complication in the freight rates on coke, and a continual process of readjustment has been in progress during recent years. Furthermore, the use of coke as a domestic fuel places it in direct competition with anthracite, so that, according to the system of freight-rate adjustment commonly followed, coke freight rates must be considered in comparison with anthracite rates. This relationship, however, has not been completely worked out, by any means.

The relation between the freight rates on bituminous coal and on coke made from it is also important. If the rate on coke is relatively too high, it unduly favors placing the by-product oven near the point of coke consumption, perhaps thus working some economic injustice or some disadvantage to industry as a whole; on the other hand, if the coke rate is relatively too low, there is too much tendency to place the coke-oven plant near the mine. Hence, even though coke and bituminous coal are not direct competitors for domestic heating, their relative freight rates are important to the users of both coke and coal.

In order to eliminate as much as possible any complication of the relation between the bituminous coal and the coke freight rates, the establishing of special rates on coke, similar to the "milling in transit" rates on grain and grain products, has been proposed. The argument for such freight rates is that they would allow the by-product-oven plant to be placed at the point which in all other respects would permit the most economical operation. As yet no general approval of this idea has been given by the Interstate Commerce Commission, although in a few cases some railroads have voluntarily established freight rates which are more or less equivalent to the "coking in transit" rates proposed.

It is sometimes urged that the regular supply of coke in any market would be more certain if the coking were done at the mines, since then there would be no chance of interrupting the railway movement of the coal to the oven plant. It should not be forgotten, however, that the movement of coke takes as many cars as the movement of the coal, so that the certainty of coke supply is probably not materially affected by placing the oven at the mine.

As a matter of fact, a coke-oven plant carries 20 to 60 days' coal supply in its storage piles in order to be insured against any interruption of operation through shortage of coal. Any brief interruption of railway traffic is therefore not of great consequence to the oven plant. Moreover, when the coke ovens are at a metallurgical center they can easily draw upon a variety of coal supplies in case of need. This interruption of the coal production at a single mine or group of mines is not serious unless the oven plant is so situated that it must get its coal from that particular source. For this reason it is often maintained that the certainty of operation is greater, so far as coal supply is concerned, when the oven plant is not at or near the mine.

When carefully analyzed, the above considerations are of relatively little importance as affecting the coke market; the really important consideration is to have the oven plant so situated that the over-all costs and the over-all return from coke, gas, and by-products are most advantageous. For this reason no generalizations can safely be made as to the influence of freight rates upon the coke supply or market price. This factor enters to widely differing extent, sometimes on one side and sometimes on the other, in any particular case.

SUMMARY

Some outstanding features of the coke-marketing problems are summarized in the following paragraphs:

Coke is now made principally in by-product ovens which save gas, tar, and other valuable constituents that beehive ovens waste. The beehive ovens afford a reserve capacity for coke production; they operate with increasing output to meet increasing demand and with lowered output in time of business depression.

Over 75 per cent of the coke produced is manufactured at plants affiliated with iron and steel companies. This coke is not really sold but is transferred by an interdepartment credit and charge on the books of the corporation owning both the coke plant and metallurgical works.

By-product coke is now preferred for metallurgical work. Continuation of beehive-oven operation, with accompanying waste of by-products, is possible largely because of the very low investment in the ovens and because of the facility with which they can be started up or shut down to meet the fluctuating demand for coke.

Preparation of either blast-furnace or foundry coke ordinarily leaves a considerable quantity of small-size coke which can best be used as a domestic fuel. Maintenance of domestic coke markets is therefore important to the metallurgical coke-plant operator as well as to the merchant coke-plant owner.

If properly prepared for the market, the small-size coke can be used with satisfaction for household heating. It finds a market promptly only if a regular supply and favorable prices can be maintained.

Domestic coke should be carefully sized, should be free from breeze or fines, should contain a low percentage of ash—this ash to have a high melting point—and should be as dense and as free burning as possible.

Much educational work is the chief remaining need for the establishment of a large demand for domestic coke. This work often requires personal advice to the customer and a demonstration of how to burn coke satisfactorily in his own house-heating plant.

Much gas-works coke is used for heating the coal-gas retorts, and large additional quantities are used for manufacturing water gas. However, low-cost production of coal gas for city distribution makes necessary the development of regular local markets for the surplus coke—markets which must usually be established in the field of household fuel.

Industrial uses of coke, besides those in metallurgy, are numerous, but as yet they absorb very small percentages of the total output of coke.

Virtually no coke is imported. The exports are a very small fraction of the total production. No important influence on domestic markets can be expected to result from either imports or exports of coke.

Coke breeze and fines are wasted at the beehive oven but are generally utilized, though often inefficiently, at by-product ovens. The principal use is as boiler fuel, but recent developments provide a very efficient use for breeze and small domestic sizes through the making of producer gas with which to heat the coke ovens. This practice releases a large proportion of the oven gas for sale or for uses that can not be served by the breeze.

Present freight rates are said to prevent the coking of coal at points where the best markets for the products are found. Moreover, freight rates for coal, beehive coke, and by-product coke are often distinctly in favor of one or the other for a particular locality. Thus, available markets are often restricted by competitive freight-rate conditions.

Figure 24 shows the cost of coal and the value of all products per ton of coke and Figure 25 the by-products and gas produced at by-product coke plants.

GAS FOR INDUSTRY AND CITY SUPPLY

A PECULIAR MARKETING PROBLEM

The marketing of gas from coke-oven or coal-carbonizing plants presents a very different problem from that implied in the usual sense of the term "marketing." The gas is an essential product of carbonization and can be used for fuel purposes only. It must be used with-

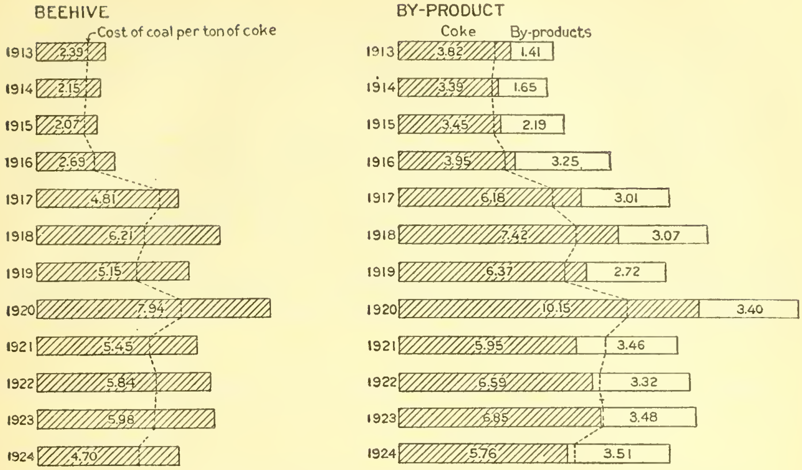

FIGURE 24.—Cost of coal and value of all products per ton of coke produced, 1913–1924

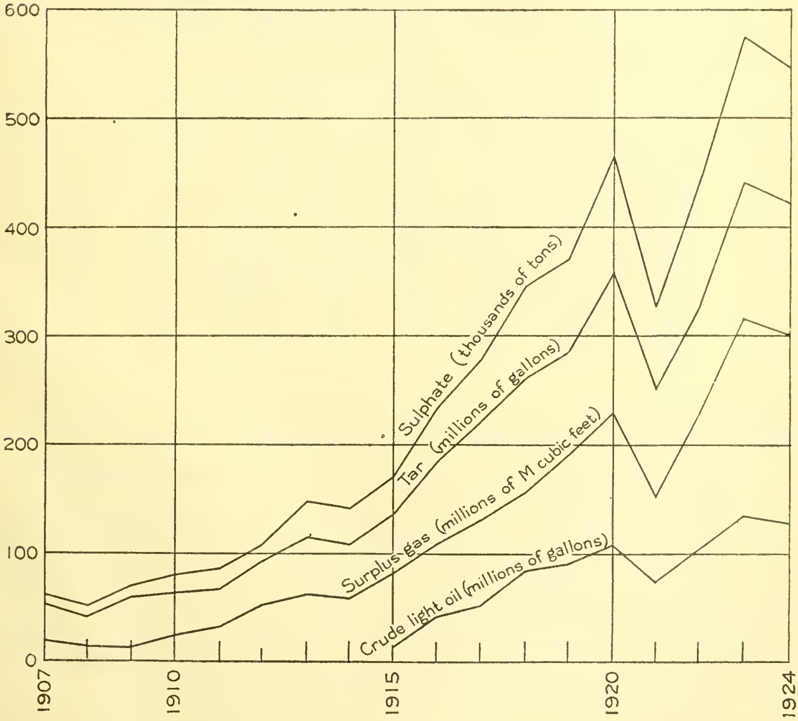

FIGURE 25.—By-products and gas produced at by-product coke plants, 1907–1924

in a few miles of the plant at places which can be reached by gas mains or pumping lines. Moreover, it is very bulky, and so can not be stored for more than a few hours, certainly not longer than one day after production. In these respects the gas differs from any other of the products, which not only can be stored but also can be shipped indefinite distances before use.

The beehive coke oven produces no gas for sale, so there is no gas-marketing problem at such plants. Gas made in the by-product oven may be used in part for processing the coal, but some or all of the gas is surplus and can be sold. It is this surplus gas from by-product ovens that demands most careful consideration in this report, because it makes up nearly 90 per cent of the total gas from coal which is sold in the United States. The gas made at coal-gas works, which makes up the other 10 per cent, is invariably distributed through public utility systems.

TABLE 84.—*Production of manufactured gas in the United States, 1898–1924*

Year	Quantity (billions of cubic feet)						Per cent of total sold or used		
	By-product oven gas		Retort coal gas produced and sold	Water and oil gas produced and sold	Total		By-product oven gas	Retort coal gas	Water gas and oil gas
	Produced, including gas used in heating ovens	Surplus sold or used			Produced	Sold or used as surplus			
							Per cent	*Per cent*	*Per cent*
1898	(a)	4	18	31	(a)	53	8	34	58
1902	(a)	4	25	(a)	(a)	(a)	(a)	(a)	(a)
1903	(a)	5	26	(a)	(a)	(a)	(a)	(a)	(a)
1904	(a)	5	30	(a)	(a)	(a)	(a)	(a)	(a)
1905	(a)	10	31	77	(a)	118	9	26	65
1907	(a)	20	34	95	(a)	149	13	23	64
1908	(a)	16	38	103	(a)	157	10	24	66
1912	(a)	54	35	123	(a)	212	25	17	58
1915	214	84	44	138	414	266	32	16	52
1917	238	131	43	168	577	342	38	13	49
1918	385	158	43	192	646	393	40	11	49
1920	476	230	43	220	766	493	47	9	44
1922	443	231	42	216	724	489	47	9	44
1923	601	318	[b] 260		861	578	55	[b] 45	
1924	541	301	[b] 260		801	561	54	[b] 46	

[a] Data not available.

[b] Estimated from census reports. Retort coal gas combined with water and oil gas.

QUANTITY AND VALUE OF COAL-GAS PRODUCTION

The data in Table 84 show the extent to which gas has been made from coal during recent years. These data make it evident that coke-oven gas and water gas are by far the most important elements in the supply of manufactured gas. Coal gas made in retorts forms only a small percentage of the total manufactured-gas production. For the sake of comparison the other source of fuel gas, the marketed production of natural gas, is also included.

Data on the utilization of gas made from coal are given in Table 77, page 656, and are shown graphically in Figure 26. This table and chart bring out strikingly the relation between gas used by the producer, gas marketed for the use of affiliated companies—the two main applications of coal gas—and gas sold for city distribution or for miscellaneous industrial purposes. A comparison of conditions in 1923 with those existing a few years before not only emphasizes the rapid increase in production and use of coal gas but also shows the much greater extent to which this gas is now used for city supply. Under present conditions the gas is the most valuable by-product sold from coke ovens, and is, of course, the most important revenue producer in coal-gas companies having retort plants.

RELATION OF MARKETS TO AVAILABILITY OF GAS

In projecting a new coal-processing plant careful consideration must be given to the disposal that can be made of the gas that it will produce. This is especially important for plants not associated with iron furnaces and steel works. For such nonfurnace plants the quantity of gas which can be sold at a good price often determines the size of the plant which can profitably be erected; and the location of the market for the gas, which must exist close to the producing plant, determines the location of the plant and therefore the availability of its fuel. Moreover, if the demand for gas is large in relation to the demand for coke, an effort will usually be made to increase the output of gas without increasing coke production. Thus, the system of plant operation, or even the type of plant chosen, may be affected by the extent of the market for gas.

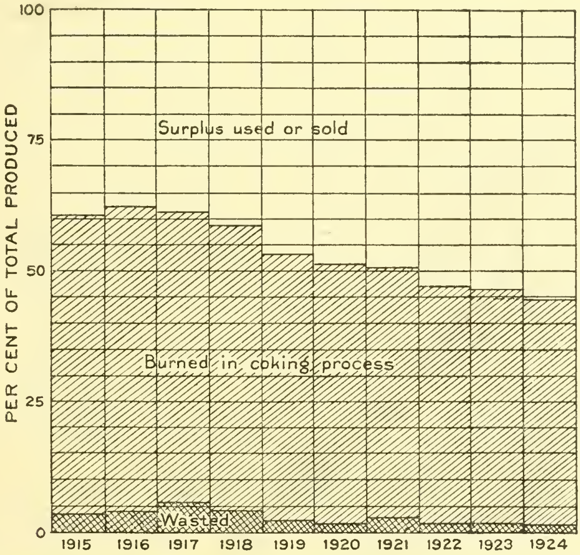

FIGURE 26.—Disposition of gas produced at by-product ovens, 1915–1924

On the other hand, often the main objective in operation is the production of blast-furnace coke, and then the gas may be used advantageously in the associated steel plant in such heating operations as may most efficiently consume it. Under these circumstances, which are typical of the by-product oven plant connected with steel works, an outlet for the gas is already at hand, and the question of an outside market need not be considered in the choice of a plant, plant location, or system of plant operation.

These widely varying conditions that affect the quantity of gas also affect prices. The price realized for gas by producers in the United States varies widely; some producers receive less than 5 cents per thousand cubic feet, whereas other producers market the gas for $1 or more per thousand. This wide variation in price does not at all imply a variation in quality. The price is determined rather by the price of competing fuels in the local market and by the extent to which the price must include costs for rendering service to the gas customers.

USE OF GAS BY PRODUCER

Where the surplus gas is simply pumped from the coke-oven plant to a near-by affiliated steel plant, the coke department incurs no cost for selling, storage, or handling, and can profitably accept a nominal price per thousand for the gas thus delivered. On the other hand, the public utility company which operates a coke oven must purify the gas, store much of it until the hour of peak demand, distribute it throughout all parts of the city served, and render a great deal of public utility service. All of these costs enter into the charge for gas, and the price at the user's premises is therefore comparable with the price of gas made by other processes and sold for city use. Between these two extremes are many variations of company operation. A typical one is the coke-oven company which purifies the gas, provides some storage space, and then pumps it from its holders to the holders of the public utility company which purchases the gas for city distribution. In such case the extra cost at the works enters into the price realized by the producer, but the costs of city distribution and of service to the ultimate consumer do not become a part of the producer's expense.

Many coke-oven works are affiliated with a blast furnace or steel plant; then the surplus gas from the coke department is usually burned in the metallurgical departments. Under such circumstances there is no real sale of the gas, only an interdepartment transfer. The practice of many such plants is to give the coke department credit for gas on the basis of the plant cost of the quantity of bituminous coal for boiler use which the gas can theoretically replace. Such an allowance, of course, may be far below the real value of the gas, but it is of no concern to the management how such record is kept, because the profits of the company as a whole are unaffected by interdepartment bookkeeping. It is from plants such as these that the Government receives reports of a sales realization of only 4, 5, or 10 cents per thousand, and it is these reports which bring down the general average sales realization to so low a figure for the country as a whole. This influence is greater than the number of plants concerned would appear to indicate, because the plants following this practice are among the largest in the country.

SALE OF GAS FROM COKE WORKS

Instead of using the gas in the metallurgical department, the by-product oven operator will sell the gas to industries or to a public utility company when he can realize more for it than it is worth in his own business. It is not enough, however, that the price be higher than the bookkeeping value; often the advantages of a dependable gas supply under his own control will make this fuel worth more to the producer than the bookkeeping value assigned.

Moreover, the producing company is often unwilling to enter into a contract to supply gas over an extended period, because to do so would necessitate operating the plant in order to meet the gas contract even during periods of depression when the market for coke and other products was poor. At such a time a contract to supply gas would often be a serious embarrassment, forcing full plant operation at considerable loss; also, the producing company may not be able to produce gas of just the heating value desired for city distribution without some sacrifice in the quality or yield of coke. Under these circumstances even an attractive price for gas is not enough to induce the coke-works operator to contract to supply gas for public utility use; he would rather sell the gas at a lower rate to industrial users who do not impose this limitation upon gas quality.

There are very few instances where even the isolated oven plant finds it can not market its gas or use it with reasonable economic advantage. In fact, the existence of surplus gas not required by the producer is likely soon to attract other manufacturers desiring to avail themselves of this cheap and efficient fuel. Therefore, waste of gas from by-product ovens is almost unknown, except for very short periods when local conditions temporarily prevent either use or sale.

VALUE OF GAS AT COKE WORKS

The price of gas is not a measure of service value. The value is largely determined by the heat content and the price by market conditions that affect competing fuels. Moreover, gas will probably do more work per million heat units contained than any other fuel, because it can be burned under conditions of exact control, with a minimum of labor, and with the highest furnace efficiency attainable. Often in setting the price the producer takes no full account of these advantages, because he is primarily interested in coke and other by-products, and being compelled to sell the gas promptly near the works he takes what he can most readily get for it. The bookkeeping value assigned to gas transferred from the coke to the steel department of a metallurgical company is an extreme example of the low value placed upon gas.

When the gas is to be sold from coke works to a public utility company for city distribution, the price becomes a matter of negotiation. However, contracts entered into by the public utility company must usually be approved as to price by the city or municipal authorities who regulate public service corporations. Hence, the coke-works company in some measure comes under the control of public authorities as to the price which it can obtain for this important product. This control, however, seldom presents serious difficulty, for the company can usually afford to accept a price that is distinctly less than the cost of making gas by other processes in the plant of the public utility company itself, and the regulating officials usually recognize that the public's interest is best served by such a contract. Whether or not a contract will be entered into and approved is determined largely by the same conditions that decide whether a coal-gas plant should be built rather than a water-gas plant. These conditions are discussed in the following section.

WHEN COAL GAS IS LIKELY TO BE MADE

Throughout these sections of this report the term "coal gas" is used to mean both retort coal gas and gas made from coal in by-product coke ovens. The two kinds are practically identical in their general characteristics and their value to the user. Whether a retort plant or an oven plant is chosen for any particular installation is a matter determined by other considerations, never by any slight difference in the composition of the gas desired. The term "coal gas" should, therefore, be understood to include both oven and retort gas but not water gas or oil gas, which are made by entirely different processes.

For city distribution coal gas, oil gas, or water gas are equally suitable. The choice between them is decided mainly by the relative cost of manufacture for equal quality; that is, for equal heating value per cubic foot.

The investment required for a coal gas plant, either of retort or oven type, is much greater than that required for a carburetted water-gas plant of equal capacity. The capital charges per thousand of coal gas are therefore greater, but the operating expense is often so much less for the coal-gas processes that the over-all cost is no greater. In fact, it may be less.

For some years past the volume increases in coal-gas manufacture for public utility supply have about equaled the increases in water-gas production. The percentage increase in coal-gas output has, however, been much greater. Because of the increasing cost of oil for water-gas making it is likely that in future the tendency toward choosing new coal-gas equipment rather than new water-gas equipment will be still more marked. Probably this new coal-gas equipment will be mostly of the oven type, because the longer life of such equipment markedly reduces the capital charges per annum. However, new coal-gas equipment, requiring a larger investment than water-gas equipment, can not as readily be installed if the company finds difficulty in securing new capital.

FLEXIBILITY OF GAS-MAKING CAPACITY OF COKE PLANTS

Perhaps the most important advance that is speeding up the production of coal gas is the development of producer-gas or blue water-gas firing of the coke oven. With this system of oven heating, all the gas from the coal is available for sale when desired; or, at times of low gas demand, part of it may be used for heating the ovens. Thus, a flexibility in plant capacity has been attained that is highly important to the company whose gas demand varies considerably throughout the year.

This system of heating the ovens with producer gas or water gas not only changes the quantity of coal gas that can be used or sold elsewhere but also the ratio of gas output to coke output. Thus, one system of plant operation can be followed in time of high coke demand and another can be used in periods of low coke demand without material change of the available quantity of surplus gas for sale.

Moreover, the smaller "domestic size" coke and the coke breeze are used for firing the gas producer, and thus the disposal of this least valuable portion of the coke entails no selling expense.

In general, plants of this type have thus far been used only in connection with public utility gas companies or by coke-oven companies supplying gas for public utilities, but it is anticipated that some similar use may be made in coke plants primarily engaged in the supply of metallurgical fuel. At such plants the disposal of the coke breeze will probably be the most important advantage, although flexibility in gas capacity will also be a distinct advantage.

ECONOMIC SERVICE OF GAS AS A FUEL

The extension of industrial and domestic heating by gas is often urged on the ground that the use of this fuel permits the most economical utilization of coal. There is no doubt that, other things being equal, it is an economic service to the country as a whole to employ coal gas, coke, and other products of carbonization instead of raw coal. However, the rate at which such substitution will take place will be largely determined by the financial advantage to the ultimate consumer of the fuel, for it would be altogether unreasonable to expect industries or householders to adopt the use of gas or coke unless they can see some advantage, such as a reduction in heating cost or increased convenience or cleanliness at the cost of the old fuel.

The use of coal gas instead of carburetted water gas or oil gas is also an entirely practicable economic advance in many places. Use of the coal-gas system conserves the limited petroleum resources, yields large quantities of valuable by-products other than gas and coke, and tends toward reduction in the price of the various coal products.

A much greater investment is required for coal-gas equipment, though, and the investor must be assured that profitable markets will continue long enough for him to amortize all new money required.

GAS AS INDUSTRIAL FUEL

A few years ago the industrial users of gas required only 5 or 10 per cent of the output. Now, it is estimated that 18 to 25 per cent of the total gas sales are for industrial applications; in some communities the proportion is as high as 40 per cent of total sales. Most of these sales are made through public utility systems; so the sales methods require no discussion here. It is worth while, however, briefly to consider the important economic and technical factors that affect the substitution of gas for other fuels in industrial heating.

Theoretically, the cost of the gas per million heat units would determine its adoption; practically this is not the case, for on such a basis gas can rarely equal oil, coal, or coke. Use of gas does, however, eliminate all investment in fuel supply, make unnecessary the provision of storage space for fuel, and provide a sure, highly efficient, clean medium for heating. Working conditions about a plant using gas are generally more satisfactory, and in consequence the employees become better contented. Spoilage of work is often much less and the quality of the work is higher, because gas permits accurate quick control of furnace operation to a greater degree than almost any other fuel. Automatic temperature-control systems have been perfected which reduce labor and fuel losses to a minimum. Obviously, therefore, the choice must be based upon the total cost per unit of product rather than on the cost per B. t. u. in the fuel.

Selling gas to industries requires careful technical consideration of the process to be conducted with the heat supplied. This fact has been recognized by large gas companies, which provide special technical staffs to assist their customers or prospective customers. Manufacturers of gas-burning equipment have also done a great deal of such work and are prepared to assist local gas companies and industrial consumers in trying out gas-heating methods and devices. The result has been the development of a wide variety of furnaces, gas-heated ovens, and other gas-burning equipment suited to virtually every industrial need. Recently the American Gas Association has been giving particular attention to this problem and is serving as a technical clearing house and coordinating agency. Thus, the prospective user of gas has access through his local gas company to a very complete collection of information bearing on problems similar to his own.

The greatest advance made through this type of service has been the recognition of the need of better design in industrial furnaces and heating equipment. Many of the advances made when oil, powdered coal, or gas are substituted for lump bituminous coal in industrial plants come about through proper regulation of firing conditions and a careful study of the principles involved in the heating operation itself. There are certain advantages inherent in each of these substitute fuels, but no one of these advantages can compare, in its importance to industry as a whole, with good engineering in the selection, design, and operation of the heating equipment.

PUBLIC UTILITY GAS-RATE SCHEDULES

Often it is impossible to sell gas industrially because the price charged large purchasers is the same as that charged the occupant of a small apartment. Obviously, the distinction in the price charged, between the wholesale purchaser of gas and the occasional user in the kitchenette, should be as large as that between the industrial purchaser of any commodity in wholesale quantities and the man who buys but a single pound or a single package. More and more, therefore, public authorities are requiring that gas-rate schedules provide for wholesale rates as well as for what may be termed "retail" rates for small purchasers.

Such rate schedules are entirely fair if properly drawn. One scheme which seems to be more favored than any other makes a fixed monthly charge for each customer plus a small charge for each thousand cubic feet of gas consumed. The monthly charge for any customer depends on the service which that customer can demand of the company, or, in other words, the extent to which he may become a gas user without notice to the company, simply by turning on the gas appliances in his establishment. The householder with a small-size meter and few appliances can create but little demand for gas and therefore is charged only a small sum per month. The occupant of a very large house, or a house where large water-heating and house-heating equipment is installed, can impose a greater load upon the gas-distributing system, and he necessarily has a larger service pipe, larger meter, and other facilities in proportion; his monthly charge is greater than that of the small householder. The industrial plant which requires even greater equipment from the gas company and may impose much larger demands upon the system pays a still larger monthly charge.

Under such a scheme the "customer's demand" charge may range from 30 cents to $10 per month, according to the class of customer; but this charge entitles the user to no gas whatsoever. Supplementing this customer's demand charge, the commodity charge might be 50 to 75 cents per thousand cubic feet, and is the same for all users. This is fair to all, since the commodity charge primarily represents the cost for manufacturing which remains the same, regardless of the use made of it or the quantity used by the customer to whom the gas is sold.

Such a rate schedule, when in force, permits the wholesale purchaser to use gas upon the most favorable terms. If he wishes to use the gas only for occasional or incidental plant purposes, he properly pays for this privilege in the monthly customers' charge; but he then can use as much gas as he pleases at the low average rate per thousand which is possible under such a rate schedule. It is obvious that the average per thousand under this rate schedule is much less than under the so-called "flat rate," where none of the customers' or demand expenses are cared for by special monthly charges. With such a "flat rate" the wholesale user of gas is often paying much more than his share of the general items, and consequently finds gas more costly than other fuels.

GAS FOR HOUSEHEATING

If gas were available at low cost, it undoubtedly would be the ideal household fuel. This fact is proved by the experience of millions of householders in territory where natural gas is sold at low prices; but if manufactured gas is to be the fuel for househeating, the manufacturing plant must be ready to take care of the demand on the coldest winter days. Naturally, much of this plant will be idle during most of the year. Recent investigations in cities in Northern States indicate that the average demand for household supply would be only one-seventh of the plant capacity if the plant were big enough to care for the coldest winter days. The situation would be still worse if the plant had to be big enough to care for the hour of maximum demand; under such circumstances the plant might be twenty times the size needed on the average throughout the year. Obviously, a great investment is not justified if the plant is to be idle most of the time; hence, use of gas for househeating can not be indefinitely extended except in connection with other kinds of business which will use the bulk of the gas during periods when there is little or no need for heat in the home.

Despite the problems of obtaining sufficient plant capacity to care for househeating, there have been marked increases during the last few years in the sales of gas for that purpose. Particular progress is being made in the use of gas for auxiliary heating to supplement the principal househeating plant (which would burn oil, coal, or coke) either on extremely cold days or during the spring and fall, when only a little fire is needed. Gas men conversant with this problem forecast still further increases for auxiliary heating and some additional demand for gas as the primary fuel. Perhaps the greater flexibility in plant output that recent types of coke ovens have made possible will stimulate this development still further.

STANDARDS OF GAS QUALITY

As gas is used only where heat is desired, heating value is the primary consideration as to quality. In the United States it is customary to measure the heat value of gas in terms of British thermal units given out per cubic foot of gas burned, commonly referred to as B. t. u. per cubic foot. For industrial and household heating the heat value is a direct measure of the actual as well as theoretical usefulness of the gas. Experimental work done in a number of laboratories has indicated that for such processes as cooking, heating water, and baking, also, the heat value of a gas is a direct measure of its usefulness to the householder. As a consequence, bodies that regulate public utilities have required that gas companies maintain certain standards of heat value. More and more it is being recognized that such standards are just as important as the rate charged; in fact, the two are so interrelated that a change in one may require a change in the other in order that an equitable relation may continue between the gas company and its customers. Recent official decisions recognize this fact directly, some States making it compulsory that the standards adopted, "expressed as a part of the schedule of rates," be filed with the commission.

There has been a widely prevalent but wrong idea that any gas of lower heating value per cubic foot than is commonly supplied is unsatisfactory for household and industrial use. This idea has no foundation in fact and is rapidly being dispelled. Within the range of heating values prevailing in the United States there is no inherent technical advantage in any particular value, provided the gas-burning appliances are properly adjusted to the gas. But, of course, the desirability of higher or lower quality depends upon the price at which it can be sold, and the gas that permits regular and uniform delivery to the customer of the most heat per dollar of cost to him is the best.

The question of standards of quality usually has been considered primarily as a matter of equity in the relations between public utilities and the public. It certainly should not be permitted to interfere with the further development of markets for gas from coal simply because the present requirement as to quality precludes the choice of the most efficient system of plant operation or of the most desirable coal from which to make the gas. Under all circumstances the standard should be adjusted to permit efficient and economical marketing of gas.

SUMMARY

Some of the more important points bearing upon the fundamental economic problems of coal-gas marketing are briefly stated as follows:

Gas is the most important coal product other than coke. It must be delivered to the ultimate user within a few hours of production and can be sold only at points profitably reached by gas-pipe lines. The market for gas from any plant is therefore very sharply limited.

Virtually none of the gas made at coke plants connected with metallurgical works is sold, but all is transferred to the affiliated steel plant and burned for heating operations. This transfer is therefore interdepartmental and is usually shown as a bookkeeping charge against the user company on the basis of the value of the fuel replaced by the gas.

Prices realized for gas at coke works do not represent the real market value or even the economic service value of this fuel.

Large and constantly increasing quantities of gas from by-product ovens are being used for city distribution. Coke plants connected with metallurgical works are, however, often unwilling to contract to furnish gas for this purpose, both because they have profitable use for the gas and, which is more important, because they can not afford to make a contract that may require operating their ovens to supply gas when they do not need coke.

Production of coal gas in by-product ovens for city supply is increasing rapidly and to a considerable extent is replacing the production of water gas. Whether coal gas or water gas is made is determined by the relative cost of the two.

The prices that can be realized for the coke and the by-products largely determine the cost of the gas made in a by-product oven. The demand for the several products is therefore of direct concern to the city gas user and will largely govern the rate of future development.

Use of city gas for industrial heating is increasing rapidly. The increase is more rapid than the relative cost of gas per million heating units contained would seem to make possible, because gas can be used more efficiently than any other fuel. As a result there is a constantly increasing number of cities in which manufacture of coal gas and other coal products is economically possible. The markets for coke and by-products must correspondingly increase.

The price schedule fixed for gas by public authorities often determines the possible demand for gas for industrial heating. Some form of two-part or three-part rate is essential for the most rapid development of this market. Such a rate schedule is the only equitable one for most American municipal conditions; a flat rate is rarely, if ever, wholly fair to all classes of users.

The heating value of a gas is a direct measure of usefulness to the customer; the standard of quality is just as important as the price per cubic foot. Standards should be fixed so that the purchaser can secure the maximum amount of heat per dollar of total cost to him, and so that the most efficient methods of manufacture and the most desirable kinds of coal can be employed.

MARKETING TAR AND TAR PRODUCTS

POPULAR MISCONCEPTIONS

The popular conception of tar products, apparently, is that they are a marvelous group of beautiful dyes, sweet-smelling perfumes, life-restoring medicinals, and other remarkable products of synthetic organic chemistry. All these are exceedingly important products made indirectly from coal tar, but to the man who must sell tar from a plant that processes 5,000 tons of coal a day they are negligible. A day's output of tar from a single plant would make more of some of these fine organic chemicals than could be marketed in the course of a year in the entire world. Industrially the products of real importance are the road oils, roofing materials, pitch, wood-preserving compounds, solvents, dyestuff intermediates, and liquid fuels which coal tar makes available for American industry.

In so brief a report as this it is impossible to attempt more than a crude separation of the truth from the fiction which has been created by the picturesque writing of those who undertake to popularize this branch of science. It is feasible to discuss only the major or primary products of tar refining, for a consideration of the many ramifications in industry of secondary products would carry one to points of no practical interest for the tar-marketing division of the coke and gas business.

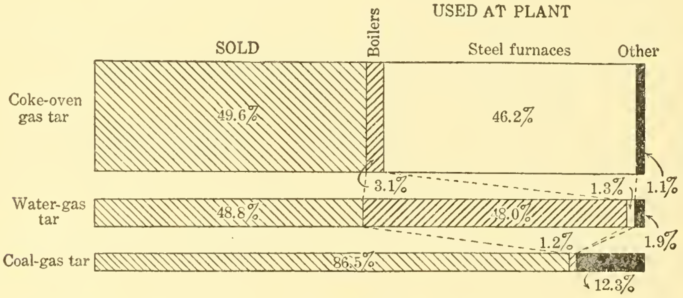

FIGURE 27.—Disposition of tar produced by coke ovens and gas works in 1922

QUANTITY OF TAR PRODUCED AND USED

Other than coke and gas, tar is by far the most important product of coal carbonization if judged either by weight or by the heat that it contains. Tar represents 4 to 6 per cent of the weight and 5 to 8 per cent of the heat of the original coal from which it is made. Often it is also the third product in importance on the basis of income derived from its sale or of the value that it affords the producer in other operations about his plant. In some cases, however, the ammonia, and rarely the light oils, are more valuable than the tar.

Statistics gathered by the United States Geological Survey and Bureau of Mines from gas works and coke plants afford the best basis for estimating tar production and the consumption of tar by the producer. (See Table 61, p. 647, Table 85, and fig. 27.) Figures gathered by the Tariff Commission afford a correspondingly good basis for estimates on the consumption of the principal tar products made in the United States.

TABLE 85.—*Production and sales of coke-oven, coal-gas, water-gas, and oil-gas tar in the United States, 1918–1924*

	Coke-oven tar	Coal-gas tar	Total coal tar	Water-gas and oil-gas tar
Production (gallons):				
1918	263,299,470	52,694,826	315,994,296	100,985,156
1919	288,901,739	([a])	340,900,000	([b])
1920	360,664,124	51,264,956	411,929,080	116,073,907
1921	253,051,649	([a])	303,000,000	([b])
1922	327,779,734	48,082,228	375,861,962	104,555,028
1923	440,907,109	([a])	488,900,000	([b])
1924	422,074,326	([a])	470,000,000	([b])
Sales (gallons):				
1918	200,233,002	47,727,839	247,960,841	55,283,484
1919	217,707,157	([a])	264,900,000	([b])
1920	174,363,696	46,604,133	220,967,829	59,238,730
1921	135,293,047	([a])	179,200,000	([b])
1922	162,204,417	41,266,074	203,470,491	47,338,489
1923	211,739,469	([a])	254,700,000	[c] 49,990,840
1924	209,979,999	([a])	253,000,000	([b])
Value of sales:				
1918	$6,364,972	$1,863,580	$8,228,552	$1,805,865
1919	6,918,549	([a])	8,800,000	([b])
1920	6,378,040	2,010,186	8,388,226	2,109,388
1921	5,645,309	([a])	7,760,000	([b])
1922	6,419,743	1,955,950	8,375,693	1,879,490
1923	9,250,552	([a])	11,400,000	[c] 2,001,363
1924	9,623,520	([a])	11,772,000	([b])

[a] No report. Estimate included in total.
[b] No report.
[c] As reported by Census of Manufactures.

In these summaries of the data the production figures for coal-gas works and coke-oven plants are kept separate because some of the properties of the tars made by the two processes differ decidedly. This comes about mainly because horizontal gas retorts are operated at temperatures higher than those usual within the carbonization space of the by-product oven. The horizontal retort tar is generally less fluid, contains more of the free carbon that has been formed by the cracking of the tar vapor at excessive temperatures, and more of those constituents which upon distillation of the tar yield pitch and coke. Moreover, retort tar usually contains a large amount of anthracene and naphthalene constituents, which in the refining of the tar are separately recovered and extensively used as raw materials in the dye and organic chemical industries. Vertical retort tar is still different in character. Either retort tar or oven tar may be the more valuable to the refiner, depending upon the purpose to which it is put. Often a combination of the two is better than either alone.

TAR AS A FUEL

More tar is burned by the producers, either in boiler plants or affiliated metallurgical plants, than is refined or sold for other purposes. The tar so used by the producer falls in exactly the same class as the coke and gas used at the coke ovens or in affiliated metallurgical plants. No marketing problem is involved, and only a bookkeeping value is assigned as a financial record of the transaction.

Often the question is raised why more of the tar produced at coke ovens connected with steel works is not distilled instead of being burned. The answer apparently is not based on technical considerations alone; business and economic factors control disposal. The management of the combined coke and steel plant has a coke plant to insure only a certain and satisfactory supply of coke for its blast furnaces; it is not anxious to extend the coke department further into the realm of chemical engineering by arranging to refine the tar produced. The tar furnishes a most excellent fuel for use in the open-hearth steel department usually connected with such a plant. If it is sold, some other fuel equally satisfactory for the steel furnace must be purchased. Usually the substitute fuel would cost substantially as much as the tar sold, and all the annoyance and uncertainty of managing the sales of tar and the purchase of substitute fuel would be incurred without any large financial advantage.

In small coal-gas plants or isolated oven plants the tar produced is usually burned under boilers. For this purpose the tar is worth to the producer a little more than the cost at his bunkers of the fuel replaced. Hence, unless the tar commands more than the usual market price, to burn it is often a financial saving as well as a convenience. Under these circumstances even the smaller plants will market tar only when they have plenty of fine coke for boiler fuel, or when for an extended period the market price is distinctly favorable as compared with the cost of powdered coal or fuel oil.

WHY TAR IS BURNED

Although American users are importing large quantities of creosote oil and other tar products, about half of the tar produced is being burned as boiler or furnace fuel. This fact at once raises the question why so much tar is thus debased to a fuel status when chemically it is a valuable raw material for industry. The answer is only that the producer receives greater immediate profit by using tar as a fuel than by selling it as a chemical raw material.

Suppose that tar were to be refined on a large scale to make creosote for wood preserving in order to replace imported material. The tar refiner who planned to do this could adopt any one of three courses. He could make light oil, creosote oil, and soft pitch, hard pitch, or tar-still coke, depending upon the relative market demand for these three solid products. If coke were made, he would get a maximum yield of creosote; if soft pitch were made, the creosote yield would be a minimum. As a matter of fact, however, even though his main object is the making of creosote, he can not, under many circumstances, use the process giving the largest yield of this desired material, because the market for the still coke produced is limited or altogether lacking; moreover, he can not simultaneously make creosote oil and road tars, as the two require many of the same constituents of the raw material.

If a tar that might be marketed at 5 or 6 cents a gallon is refined with a yield of about 50 per cent of its volume in creosote oil worth 10 or 12 cents a gallon, then the creosote oil will just pay for the raw material from which it is made. The other products, coke and very small quantities of light oil, must pay for the operating costs of the refinery, all interest on investment, overhead expenses for doing business, and the profits earned. Obviously, unless the market for still coke is unusually good, the profits from such an operation are likely to be negative. This simple example again emphasizes the necessity of balanced markets and the difficulty of preventing the tar from going into fuel uses rather than to the refinery where it becomes the raw material for many commodities of a large potential market.

Metallurgical companies owning coke ovens have reasoned exactly like this; and often, if not usually, they have concluded that it is more profitable to them to burn the tar as a furnace fuel than to sell it at such prices as the tar refiner can afford to pay.

MARKETING TAR FROM COKE AND GAS WORKS

The manager of a plant that has no use for tar as fuel often wishes to dispose of tar with the minimum of trouble to the operating staff. Although the tar contains about 6 per cent of the heat and is equal to at least 4 per cent of the weight of the coal originally handled, to the company it is an incidental product, more a nuisance than anything else if it must be cared for in detail. Consequently, there have grown up the practices of marketing the tar on a commission basis through a tar broker or, more commonly, of selling the entire output in advance to a tar-refining company.

Contracts covering tar production for several years are often made with such concerns. As a result there is practically no such thing as a spot market price for tar. Virtually all of it is sold on long-time agreements, often with provision for readjustment of price according to the cost of coal. As will be seen from the data and the diagram given (fig. 27), only a small percentage of the tar produced at either gas works or coke plants is refined by the producer, and this percentage is handled at the plants of a very small number of concerns.

DISTILLATION OF COAL TAR

In order to separate its various constituents tar is distilled. Sometimes the distillation is so conducted as to remove only the most readily volatile parts of the tar, in the form of water and light oils. The heavier tar remaining is used for saturating roofing felt, as a base for black paint, for pipe coatings, for impregnating various fibrous and fabricated materials, and for the surface treatment of roads. If production of a soft pitch for road binder, paving-block filler, waterproofing, or built-up roofing is desired, removal of still more of the light constituents is necessary; and if a more complete distillation is desired all of the readily volatile constituents may be driven off, leaving in the still either a hard pitch or a coke, depending upon whether or not the temperature of heating is raised to the point where the pitch breaks up to form finally a charred coke-like mass.

This coke may be sold for chemical uses, but usually finds its market as a fuel, although it burns on a grate with difficulty because it contains little ash. Moreover, it can not in any event be substituted for the typical by-product-oven or beehive-oven coke, because it is soft and friable and rapidly breaks into fine pieces upon handling. It is wholly unsuitable for use in a furnace where the fuel must withstand any shock or bear any weight, as in metallurgical furnaces, but is well suited to certain industrial operations requiring a solid fuel containing virtually no ash and very little sulphur. This coke as sometimes specially prepared has strength enough for special metallurgical uses.

Those constituents which come off from the tar before the vapor temperature reaches 200° C. are mainly the benzol and other light oils, with part of the nitrogen bases and part of the phenols. Between 200 and 300° C. most of the naphthalene, the remainder of the bases and phenol, the heavy oils, and some of the anthracene, are removed. If the distillation stops at this point, the remainder in the still is a soft pitch containing most of the anthracene; if the distillation is carried further a hard pitch (one of high softening temperature) is produced; and if a still higher temperature is attained before heating is stopped, the residual mass in the still will be a coke of very light, porous structure, containing a small percentage of volatile matter.

Tar made in a coal-gas retort usually gives 1 to 5 per cent by weight of light oils, 25 to 50 per cent of heavy oils, and 45 to 65 per cent of coke, or 50 to 75 per cent of pitch. The yield of pitch varies widely, depending upon the characteristics wanted, particularly the melting point.

The quantities of these various products made in the United States, so far as the available data permit, are given in Table 86, taken from the reports of the United States Tariff Commission.

TABLE 86.—*Chief coal-tar products made in the United States at plants other than coke ovens or gas works, 1917–1924* [a]

[From the annual Census of Dyes and Other Synthetic Organic Chemicals, published by the U. S. Tariff Commission]

Name	Quantity	Value
1917		
Total crudes		$14,868,293
Benzol [b] gallons	3,082,774	1,536,495
Toluol [b] do	1,788,843	2,973,702
Xylol do	92,898	63,772
Solvent naphtha do	1,126,277	247,373
Dead or creosote oil do	42,701,962	3,739,805
Pitch of tar net tons	440,304	4,624,107
Other distillates gallons	8,059,071	1,055,832
Refined tars barrels	1,133,375	627,207
1918		
Total crudes		22,474,075
Benzol [b] gallons	3,015,848	994,161
Toluol [b] do	1,596,353	3,044,890
Xylol do	192,969	67,935
Naphthalene, crude do	40,138,092	1,281,440
Solvent naphtha do	772,489	164,068
Dead or creosote oil do	44,712,012	4,428,046
Pitch of tar net tons	356,612	3,966,341
Other distillates gallons	7,034,204	1,460,363
Refined tars barrels	1,398,049	6,227,748
1919		
Total crudes		17,657,750
Benzene gallons	1,826,373	560,547
Toluene do	510,957	235,321
Naphthalene, crude pounds	12,612,203	327,201
Solvent naphtha gallons	266,013	78,817
Dead or creosote oil do	43,434,059	4,264,594
Pitch of tar net tons	283,066	3,619,339
Other distillates gallons	6,867,001	1,461,500
Refined tars barrels	1,384,047	6,540,778

[a] The instructions sent to manufacturers in the years 1918 to 1921 were as follows: "Include under 'dead or creosote oil' only products which may be used for creosoting. Include under 'other distillates' shingle-stain oils, disinfectant oils, and flotation oils which do not contain over 5 per cent of phenol. Include under 'refined tars' those tars which are used for road treatment, saturating felt, and for protective coatings. Phenol and all distillates which, on being subjected to distillation, yield in the portion distilling below 200° C. a quantity of tar acids equal to or more than 5 per cent of the original distillate are not to be included here."

In 1922 the instructions concerning phenol, etc., were modified to read as follows, the other instructions remaining unchanged: "Phenol and all distillates which, on being subjected to distillation, yield in the portion distilling below 190° C. a quantity of tar acids equal to or more than 5 per cent of the original distillate, or which, on being subjected to distillation, yield in the portion distilling below 215° C. a quantity of tar acids equal to or more than 75 per cent of the original distillate, are not to be included here." These instructions for 1922 were used without further change in 1923 and 1924.

[b] The decrease in benzol and toluol shown from 1917 to 1918 is due to the fact that certain companies which reported to the U. S. Tariff Commission in 1917 reported to the U. S. Geological Survey in 1918 by agreement.

TABLE 86.—*Chief coal-tar products made in the United States at plants other than coke ovens or gas works, 1917–1924*—Continued

Name	Quantity	Value
1920		
Total crudes		$21,163,937
Benzene gallons	875,561	287,586
Naphthalene, crude pounds	26,393,411	791,403
Anthracene, 25 per cent pure do	2,829,500	114,661
Solvent naphtha gallons	472,000	74,669
Dead or creosote oil do	37,557,245	4,395,290
Anthracene oil do	3,284,102	593,839
Pitch of tar net tons	342,401	5,245,554
Other distillates gallons	8,052,242	1,577,727
Refined tars barrels	1,386,056	7,582,553
1921		
Total crudes		17,936,160
Benzene gallons	2,171,631	463,205
Naphthalene, crude pounds	16,949,464	380,167
Anthracene, 25 per cent pure do	1,604,717	83,707
Solvent naphtha gallons	649,694	111,286
Dead or creosote oil do	28,864,156	3,188,867
Anthracene oil do	2,857,391	519,347
Pitch of tar net tons	347,011	6,514,200
Other distillates gallons	6,562,332	1,209,291
Refined tars barrels	1,029,282	5,196,427
1922		
Total crudes		21,261,849
Benzene gallons	5,708,421	1,531,134
Naphthalene, crude pounds	19,323,393	352,957
Anthracene, less than 30 per cent do	1,738,444	100,713
Solvent naphtha gallons	996,852	281,870
Dead or creosote oil do	33,874,418	3,698,319
Anthracene oil do	3,705,882	674,586
Pitch of tar net tons	371,314	6,607,673
Other distillates gallons	9,710,745	1,498,741
Refined tars barrels	1,203,089	5,758,296
1923		
Total crudes		25,067,086
Benzene gallons	394,906	118,505
Naphthalene, crude pounds	41,453,002	652,148
Solvent naphtha gallons	501,754	142,122
Dead or creosote oil do	38,636,974	4,266,785
Pitch of tar net tons	625,628	9,684,547
Other distillates gallons	14,801,569	1,941,495
Refined tars barrels	1,675,213	5,944,085
1924		
Total crudes		17,353,541
Anthracene oil gallons	693,518	116,289
Benzene do	629,934	155,973
Dead or creosote oil do	41,041,278	4,789,590
Light oil do	83,754	13,461
Naphthalene, crude pounds	34,683,803	441,333
Other distillates gallons	9,648,282	1,388,331
Pitch of tar net tons	421,580	6,439,161
Refined tars barrels	625,792	2,785,460
Solvent naphtha gallons	770,491	130,903

USES OF PRIMARY TAR PRODUCTS

The light oils, so-called because they are light enough to float on water, are chiefly benzol, toluol, and solvent naphtha. These materials are usually recovered in a separate operation at coke works, so that only a small portion of the total made is found in the tar; consequently, this group of products is separately discussed later in this report. The uses to which they are put are described there.

The heavy oils, so-called because they are heavier than water, include the higher boiling phenols (of which carbolic acid and cresols are best known), the higher boiling bases, and a large proportion of naphthalene and methyl-naphthalene. Although the heavy oils that are valuable for impregnating timber to preserve it against fungus growth and decay were originally called creosote oil on account of the presence of the phenol group, the specifications for creosote oil are, as a rule, based on physical characteristics, such as specific gravity, boiling point, and viscosity, rather than on specific compounds or the proportions of these compounds that the oil contains. Any coal-tar oil of authenticated origin having suitable physical characteristics is considered acceptable for creosote oil.

The tar acids are recovered from the oil by treatment with caustic-soda solution, which combines with these constituents to form compounds that can be removed by solution in water. The phenol is then liberated by treatment with a suitable acid, is washed, and is redistilled for purification. The crude phenol or its refined form is primarily used as a disinfectant, fungicide, or any purpose for which its antiseptic property is needed. Refined phenol and cresols are now largely used in the manufacture of synthetic resins and condensation products of the "bakelite" type.

Recovery of naphthalene from the heavier oil fractions is accomplished by cooling the material to such a temperature that the naphthalene separates in crystalline form from the solution. Purification of this material, widely used in the form of moth balls and in organic chemical work, is accomplished by recrystallization or redistillation, or both. Anthracene, a solid material much like naphthalene in general character, is separated in similar fashion from that portion of the heavy oil that is recovered at higher temperatures. Both the naphthalene and the anthracene find a large market in the chemical industries because they are the basic materials for the manufacture of many organic chemicals, dyes, and pharmaceutical compounds.

The suitability of pitch for various uses depends on its softening point and its degree of hardness and brittleness at ordinary temperatures. Obviously, a pitch that will soften at a low temperature can not be used where it will tend to flow or become sticky. On the other hand, a pitch that is very brittle at ordinary temperatures has necessarily only a limited application in work that subjects it to abrasion or impact. In roofing work both of these characteristics may be of importance, for the pitch must be hard enough to resist the softening action of the sun and yet plastic enough not to be damaged when walked upon.

Specifications for these tar products have been worked out in great detail for many different applications; the Government has adopted many for its own use. In the roofing and building trades there are scores of specifications for tar products, each suited to particular conditions of construction. Partly because of this complexity in the requirements imposed by various uses, it is desirable that the refining or marketing of tar be carried out on a large scale by an organization prepared to meet a wide variety of needs.

The individual coke or gas plant operator rarely desires to do such business, for the problems involved would far overshadow those relating to the principal object of plant operation. However, there are certain small companies that make a specialty of certain products—for example, wood preservative—instead of doing a general business. These concerns buy regularly large quantities of tar, refining it by a more or less routine system, furnishing at most three or four grades of wood-treating oil, and marketing the incidental products (light oils, pitch, and coke) of such tar refining wherever the best current market may be found. These companies put the tar to greater service than usage as a fuel, but they can use only a small part of all the tar produced.

LIMITATION OF TAR-PRODUCT MARKETS

At present the motor-fuel market will absorb virtually all of the light oils made. There is a very large and constantly growing market for pitch and heavy-tar products in making roofing, waterproofing, and similar construction materials. The tremendous increase in construction of improved highways during the past few years has afforded a correspondingly large opportunity for the manufacture of tar products suitable for use as road oils or road binders and patching compounds.

Insofar as the markets afford a reasonably well-balanced demand for the above products, one can expect a continued increase in the refining of tar, and probably there will always be available an indefinite and unsatisfied market for those tar constituents that can be used in motor fuels. The demand for the higher priced tar products, however, is severely limited. The quantity of naphthalene required for moth balls, for example, is obviously so small in relation to the possible production from tar as to make this product merely an incidental one—certainly one of no consequence to the original tar producer and of minor concern to the large tar refiner.

CHEMICAL MARKETS FOR TAR PRODUCTS

Markets for tar products in the chemical industries that use pure benzol, toluol, solvent naphtha, naphthalene, anthracene, phenol, and cresol as crudes for the making of chemicals and colors are also small as compared with the potential production. Moreover, many of these compounds can be made by synthetic chemical processes that do not use tar as a raw material. Thus, recently a large new factory was built to produce synthetic phenol, despite the fact that many times as much of this chemical as the factory will make was readily available in coal tar. If there had been a market not only for the phenol, but also for the other products simultaneously produced in tar refining, there would have been no occasion for the erection of such a phenol manufacturing establishment. Phenol would probably have become promptly available in suitable quantity and quality and at such prices as to compete favorably with the synthetic product. Obviously, however, this phenol could not be supplied by the tar refiner if he could not also profitably dispose of the other commodities necessarily made at the same time. Thus, one sees that the advantage of tar as a wonderful source of many commodities is accompanied and partly offset by the disadvantage that no one of the products can be made alone, except at excessive cost.

As a matter of fact, the existing limitation upon the supply and price of coal-tar chemicals is largely that resulting from an unbalanced demand. It certainly does not in any sense result from either shortage of raw material or lack of adequate chemical and engineering information upon which to plan further industrial development. The prices that prevail in the market for the various tar products are more an indication of the relation between relative supply and demand of the specific products than an indication of the relative intrinsic value of these commodities or of the cost of producing them separately.

TAR FOR WOOD PRESERVATION

A large amount of tar is refined for the production of creosote to be used in treatment of poles, ties, posts, mine timbers, and other kinds of wood used in contact with the ground or in marshy or wet places. This use of a tar product is typical of many in that the tar product competes directly with other materials often used to accomplish substantially the same purpose. In wood preservation the principal competing chemical is zinc chloride.

There is no doubt that railroad ties treated with creosote resist decay and fungus action very much longer than untreated ties, and that creosote treatment is somewhat superior to zinc chloride treatment when judged only on the basis of the resistance of the tie to decay. However, ties laid on lines where the traffic is heavy usually must be removed because of mechanical wear before the decay of creosote-treated ties would become appreciable. Under such circumstances the extra resistance to decay may be of no practical value, but on little-used lines and on sidings resistance to decay is decidedly important, and creosote treatment is often worth while. Thus, the anomalous result is that the most expensive treatment is used upon trackage subjected to light traffic, and that cheaper treatment suffices on trackage carrying heavy traffic.

The greatest loss resulting from failure to treat ties, poles, posts, and other exposed timber with preservatives lies in the consequent rapid depletion of timber. This example is emphasized, since it brings out a principle in marketing of tar products which is very important. These products, although often of very great value for a specific industrial purpose, are seldom the only available material for that purpose.

PRICES OF TAR AT PRODUCER'S PLANT

As pointed out above, much of the tar produced at metallurgical coke works is not sold but is used as a fuel in open-hearth and similar furnaces. The value to the producer of the tar so used is computed and recorded for cost-keeping purposes on the basis of the value of the coal replaced. As a consequence, any average figures for sales realization which include these bookkeeping values give a somewhat erroneous impression of the market price of tar.

Reports to the Bureau of Mines show that during recent years coke works have received 2 to 7 cents per gallon for the tar sold.

The average for the country as a whole is 3.2 cents per gallon in 1918 and 1919, 3.7 cents per gallon in 1920, 4.2 cents per gallon in 1921, 4.0 cents per gallon in 1922, and 4.4 cents per gallon in 1923. Plants connected with metallurgical works are shown by these reports to receive a distinctly lower average return for the tar sold than do those coke plants not so associated with blast furnaces or steel works. In 1921 the average for all tar sold from furnace plants was 4.0 cents per gallon, whereas merchant-plant operators realized 4.7 cents in the same year.

As with any commodity where the supply largely exceeds the demand, tar sold for refining can command a very little, if any more, than tar sold as a fuel. As a consequence, the tar refiner can safely offer the coke-plant operator a very little more than the boiler-fuel value of the tar and still get an adequate supply of good quality. Moreover, in any particular district there are very few companies that are in position to purchase large quantities of coke-oven tar. A material of low unit value such as this can not profitably be shipped any great distance for refining; hence, only those refiners or tar users within a relatively short rail haul of the producer's plant are prospective purchasers, and they are well aware of this fact. As a result competition for the tar output of the coke works is seldom active enough to bid up the price.

Figures summarized by the Bureau of Mines show the number of coke plants receiving different prices for tar that they use or market. These data are given in Table 87. The wide range in sales realization there shown is the consequence of the several factors above discussed, but mainly of the difference in bookkeeping value assigned to the tar used at producers' plants where no actual sales take place.

TABLE 87.—*Unit prices realized by coke-oven operators for tar sold, 1921–22*

	1921	1922
Total receipts from sales of tar	$5, 645, 309	$6, 419, 743
Average receipts per gallon:		
At plant reporting maximum average receipts	$0. 150	$0. 105
At plant reporting minimum average receipts	. 013	. 013
At average plant [a]	. 045	. 041
Average for all tar sold [b]	. 042	. 040
Number of plants reporting sales of tar	62	58
Number of plants receiving—		
Less than 2 cents a gallon	1	1
2 to 2.99 cents	4	6
3 to 3.99 cents	17	19
4 to 4.99 cents	19	20
5 to 5.99 cents	15	8
6 to 6.99 cents	4	3
7 cents or more	2	1

[a] Sum of averages for all plants divided by number of plants.
[b] Total sum of sales divided by number of gallons sold.

In assigning a bookkeeping value for tar, or in selling this material for boiler fuel or other furnace heating one should not compare either the heating value of the tar with that of the other fuel or even the relative quantities of steam generated per pound of fuel burned. Properly designed tar burners permit a large saving of labor in the boiler rooms; tar burning eliminates all ash-handling costs and tends to give increased plant flexibility, efficiency, and steam-generating capacity. All these factors enter in favor of higher prices than otherwise would be estimated for tar if compared with coal upon an equivalent fuel basis.

Tar has a heating value of about 150,000 B. t. u. per gallon, coal has a heating value of 12,500 B. t. u. per pound; theoretically, therefore, 166 gallons would give as much heat as a net ton of coal. Thus, if coal cost $5 per ton at the boiler plant, tar should cost 3 cents per gallon to be the same price per B. t. u.; but the greater efficiency with which tar can be burned and the other factors that favor its use, some of which are named above, make the practical value of tar under such circumstances about 5 cents per gallon. In other words, coal cost, measured in dollars per ton, is numerically about equal to tar cost, measured in cents per gallon, for practical boiler-fuel use. This comparison is a safe approximation for judging roughly the value of tar under most conditions, and until there is a very large increase and an improved balance in demand for the products of tar refining there is little likelihood that tar sold for refining will command a much higher price than this.

SUMMARY

Outstanding economic features of the tar market are briefly summarized as follows:

About half of the coal tar produced is burned under boilers or in metallurgical furnaces of plants affiliated with the coke plant where the tar is made. This debasing of a potentially valuable raw material of industry is justified only by the greater immediate profit returned to the producer.

Coal tar is the source of an exceedingly large number of very important products; but in regard to the marketing of tar these products are of negligible importance, because the price that can be obtained for the tar is fixed primarily by its value as a boiler fuel.

Tar transferred to metallurgical departments of a producing company is not really sold; the charge for the transaction is simply a matter of interdepartment bookkeeping in the records of the parent company.

Virtually all tar sold from gas plants and gas works is disposed of on contracts of several years' duration. There is no such thing as a spot market for tar.

The most important primary products of tar refining are light oils, road oils, roofing materials, wood-preserving compounds, naphthalene, anthracene, pitch, and pitch coke. Refinery practice varies not only from plant to plant, but also from day to day in the same plant, according to the relative market demand and price of the several products.

Much more tar would be refined if a well-balanced demand existed for all of the primary products of tar distillation. It is not economically practicable to refine tar unless all of these primary products of distillation can be sold promptly and at favorable prices.

Large quantities of tar products are imported. There is no obvious reason why a considerable part of the market so supplied could not be filled by American producers who refine tar from gas works or coke ovens. This development will, however, come slowly in order to insure properly balanced markets, stability, and permanent profits.

About one-third of the ties and a large proportion of other timber products used by railways are treated either with creosote or with zinc chloride to preserve them from decay. In this and other fields coal-tar products can be successfully used as preservatives only when the average life of the tie or other product is not unduly shortened by mechanical damage. This comparison is but one of the typical competitive conditions which virtually all tar products must meet.

Where no direct competitive material is otherwise found, tar products must often compete with synthetic products made by chemical means from other raw materials.

AMMONIA MADE FROM COAL

METHOD OF RECOVERY

The nitrogen in the original coal is divided between the coke, the tar, and the gas during the carbonization process. The only valuable part is that combined in the gas as the compound ammonia. This ammonia is recovered from the crude gas by washing with water or with acid and forms either ammonia liquor or the compound ammonium sulphate, according to which of the two liquids is used as a washing agent. In general, gas works produce ammonia liquor only; coke works almost always recover the bulk of the ammonia in the form of ammonium sulphate. The marketing of these two products requires only brief discussion in this report, for recently the Bureau of Foreign and Domestic Commerce has issued as a result of its nitrogen survey a very careful analysis of the relation of ammonia made from coal to other nitrogen sources. Readers interested in this phase of the marketing of coal products are referred particularly to Trade Information Bulletin 226, entitled "A General Review of the Nitrogen Situation in the United States," by Dr. Harry A. Curtis. A part of that review deals specifically with the problem of disposal and use of ammonia liquor and ammonium sulphate made at gas and coke plants.

PRODUCTION AND VALUE OF AMMONIA FROM COAL

In Tables 88 and 89 are summarized the production of ammonia in the United States and the yields and prices obtained by coke producers for ammonium sulphate. The prices realized for ammonia liquor sold from gas works are not very different per unit of ammonia content from the prices realized for ammonium sulphate sold from coke plants.

TABLE 88.—*Estimated production and disposition of ammonium sulphate and other ammonia in the United States, 1923–24*

[All data are tons of nitrogen]

	1923	1924
Production:		
At coke ovens	118, 500	107, 000
At gas works	5, 500	5, 500
Bone distillation, etc	200	200
From the air	3, 500	3, 500
Imports as $(NH_4)_2SO_4$	800	1, 000
Total available	128, 500	117, 200
Disposition:		
In mixed fertilizers	40, 000	45, 000
Sulphate used as fertilizer	2, 000	2, 000
Anhydrous ammonia	13, 500	13, 500
Aqua ammonia	18, 600	18, 600
In explosives	7, 200	7, 200
In ammonium salts (chemicals)	5, 000	5, 000
Export	34, 500	27, 000
Apparent increase or decrease in stocks	+7, 700	−1, 100
Total disposition	128, 500	117, 200

TABLE 89.—*Yields and prices realized by coke producers for ammonium sulphate, 1911–1924*

Year	Average price per ton of sulphate	Yield of sulphate per ton of coal	Year	Average price per ton of sulphate	Yield of sulphate per ton of coal
		Pounds			*Pounds*
1911	$53. 50	([a])	1918	$90. 00	18. 9
1912	49. 00	([a])	1919	75. 60	20. 8
1913	61. 50	([a])	1920	86. 60	21. 4
1914	55. 00	18. 5	1921	49. 50	22. 8
1915	56. 50	20. 1	1922	49. 80	21. 9
1916	62. 50	17. 7	1923	58. 60	21. 2
1917	68. 00	17. 8	1924	48. 36	22. 2

[a] Data not exactly comparable.

The reader will note that the amount of ammonia produced or sold is usually calculated in terms of the equivalent ammonium sulphate. The calculation is usually thus made because sulphate is by far the most important form of ammonia produced, and its price largely determines the price of ammonia marketed in other forms. For convenience in quick calculation one can assume that 1 pound of ammonia will make 4 pounds of ammonium sulphate, or that 1 pound of nitrogen is present in 5 pounds of ammonium sulphate.

PRINCIPAL USES OF AMMONIA

The chief uses of ammonia nitrogen in the United States are summarized in Table 88, which gives data for the year 1923. It is evident from the table that use of ammonium sulphate as a fertilizer accounts for about 70 per cent of the total domestic consumption. The market for ammonium sulphate in the fertilizer trade is therefore a determining factor in the market prices of the ammonia for most other purposes.

The object in marketing all ammonia is generally to sell as much as possible for chemical uses, but the demand for this purpose is decidedly small and usually more than supplied by the ammonia liquor from gas works. The next most attractive market is in the domestic fertilizer business, and all that can not be sold in this market usually must be exported.

The price obtained for ammonia in liquor form does not differ materially from the price of ammonia in sulphate form, although the products later made from liquor do command markedly higher prices per unit of ammonia. The quantity of liquor made depends upon the demand, but because it is cheaper to make liquor than sulphate, the price offered by liquor users need be very little if any more than the equivalent ammonium sulphate price in order to stimulate an adequate supply at all times.

MARKETING AMMONIA FROM GAS WORKS

In many small coal-gas works it is not profitable to recover the ammonia in marketable form from the gas. In such plants the ammonia, which must be removed from the gas before distribution, is washed out with a surplus of water, and the weak liquor formed is run to waste because the cost of concentrating it would be more than the product could command in the local market. It was mainly because of this general situation that out of approximately 400 coal-gas plants in the United States only 105 reported recovering ammonia during 1920, a typical year in this respect. None of the water-gas or oil-gas plants in the country produce ammonia, because it is not formed in these processes in more than minute amounts.

Of those coal-gas plants that do recover ammonia a considerable number arrange with ammonia companies or dealers to take all of the liquor made, often under contracts of several years' duration. Thus, the ammonia company may arrange either for a concentrating and refining plant close to the gas works or may contract to have the ammonia liquor concentrated to such strength that it can be shipped economically by tank car to a central ammonia plant or to the user. In either event the gas works after entering into such a contract has little concern except to recover the maximum amount of ammonia from the gas and see that there are no losses in handling and no extra freight costs because of insufficient concentration of the liquor before shipment. The real marketing problem is of concern to the ammonia company only.

Virtually all of the other coal-gas works not having contracts covering sales of ammonia market their ammonia liquor through the agency of some coal-products brokers or commission houses. Some of these companies are themselves ammonia refiners and some of them deal with other ammonia companies, but every contract with the coal-gas works is for a period of two or three years as a minimum, usually for a longer period. The producing company has, therefore, only indirect contacts with the market or occasional interest in it.

COMPETITION OF SYNTHETIC AMMONIA

The production of ammonia by synthetic chemical processes using the nitrogen of the air as raw material has developed rapidly during the last few years. As a consequence coal-gas works now find in such synthetic plants an active competitor for the ammonia market.

Very recently, therefore, there has been a decided tendency at the larger coal-gas works to consider making ammonium sulphate instead of ammonia liquor. This tendency will probably be even more marked during the next five years, as several new synthetic ammonia plants are being planned or are actually under construction. The result will be an increased supply of ammonia well suited to enter the liquid ammonia and the ammonia chemical field, with a consequent curtailment in demand for ammonia liquor from gas works. The gas works will therefore be compelled to do as coke-oven plants already have done, namely, turn to ammonium sulphate for fertilizer use as an outlet for their production of ammonia.

MARKETING SULPHATE FROM COKE WORKS

A few coke-oven operators market their ammonium sulphate themselves, but certainly 90 per cent of the production is sold on a commission basis, virtually all of it by a single company. This concern serves the various coke-oven companies as a selling agent, usually under a long-time agreement to handle all of the liquor and sulphate produced. Such agreements provide that the selling company will give the producing company opportunity to decide whether it wishes to accept any particular offer or not, but usually the advice of the selling company will be followed, because it maintains a very elaborate organization to keep in touch with production and markets in all parts of the world and can usually determine the advantage of any particular offer much better than the coke-oven management. Virtually all of the ammonium sulphate exported from the United States, which amounts to about one-third of the total production, is sold in this manner under such agency agreements.

EXPORT MARKET FOR AMMONIUM SULPHATE

For a short time following the war, when the output of the producers of ammonium sulphate in other parts of the world was very limited because of the depression in the metallurgical industries, the American producers found the export market more attractive than the domestic fertilizer market. Information now indicates that this condition will not continue much longer, if it has not already completely changed. Increased production of iron and steel throughout the world has been accompanied by an increased demand for coke and a corresponding increase in the manufacture of ammonium sulphate. The British producers, who have for years made a specialty of the far eastern markets, are again active in that field. As a consequence the export price will doubtless be lower than the domestic price most of the time from now on. Hence, the coke and gas works companies are again much concerned with conditions in domestic fertilizer markets, as these in turn determine the demand for ammonium sulphate.

In the United States relatively little effort has been made through direct advertising to create a favorable domestic or export demand for ammonium sulphate in fertilizers. This is in decided contrast with the effort made by the British, who have put out many data and a great deal of publicity material in favor of the use of ammonium sulphate, especially for tropical food crops. Some students of the

American situation have asserted that until American producers are similarly active in stimulating demand for their product either through advertising, technical publicity, or a suitable export-trade association they can not expect to build up adequate foreign outlets for the exportable surplus of American ammonium sulphate. This problem undoubtedly will be more acute as the production of ammonia continues to increase in Great Britain, Germany, and Belgium, whence a considerable exportable surplus is to be expected.

The greatest undeveloped but potential market for ammonium sulphate really lies in the domestic fertilizer business, which has not expanded to anything like its probable permanent basis. As indicated below, this market can not be developed without an extensive educational campaign, not only among the farmers who use the fertilizer but also among some of the fertilizer companies. Many of these manufacturers have been decidedly slow in changing their manufacturing system to utilize the available supplies of ammonium sulphate. With increasing fertilizer demand it seems logical that the nitrogen should be obtained from the present exportable surplus of ammonium sulphate rather than from increased imports of Chilean nitrate. Even at present it should be possible to substitute ammonium sulphate for Chilean nitrate to a large extent, because the nitrogen exported at present in sulphate is equivalent to more than 200,000 tons per year of Chilean nitrate. This is between one-third and one-half of the normal import, and by effective educational work such imports of nitrate might readily be made unnecessary. By stimulating further manufacture of ammonia in by-product ovens this would also, in a considerable measure, relieve the country of its present dependence upon a regular supply of Chilean nitrate in case of war.

AMMONIUM SULPHATE AS FERTILIZER

Various nitrogen compounds are used to furnish nitrogen, an essential element of plant food, in mixed or complete fertilizers. Aside from cottonseed meal, garbage tankage, slaughterhouse tankage, and a number of similar products which furnish the "organic" nitrogen for fertilizers, ammonium sulphate and Chilean nitrate (sodium nitrate) supply the bulk of the fertilizer nitrogen demand.

As far as most agricultural crops are concerned, ammonium sulphate and Chilean nitrate are substantially interchangeable, although each has certain advantages for certain crops or certain soils. Because of these facts the prices of ammonium sulphate and Chilean nitrate are interrelated, and the marketing of ammonium sulphate is very largely determined by the policy followed in producing Chilean nitrate and in marketing it in the United States. This question is discussed at great length in the several parts of the nitrogen survey, and only a brief summary of two or three important factors need be given here.

The large fertilizer manufacturer who is equipped to make mixed fertilizer can use either Chilean nitrate or ammonium sulphate; but to mix the Chilean nitrate directly with acid phosphate the principal constituent of most mixed fertilizers is difficult because a chemical reaction takes place that may cause a loss of much of the nitrogen in the form of nitrogen oxides. This may result not only in the waste of the valuable constituent, but also in serious difficulty through the toxic and corrosive character of these nitrogen oxides. Cottonseed meal, tankage, and similar conditioning materials reduce this trouble, but their use is limited by their greater cost. Because of these facts the large manufacturer of fertilizer uses ammonium sulphate as a principal source of inorganic nitrogen in his mixed goods.

The small manufacturer of fertilizers is usually a "dry mixer." As such he has no adequate facilities for blending ammonium sulphate with acid phosphate and subsequently breaking up the hard-caked material which is first formed and converting it into a marketable fertilizer. Such an operator, therefore, can not use ammonium sulphate unless he makes a "base mixture" or cures his mixtures as do the larger manufacturers. His sales of inorganic nitrogen are therefore generally in the form of Chilean nitrate.

All of these and other very important factors must be taken into account in the marketing of ammonium sulphate from coke works. Moreover, the price that can be realized depends largely upon the price which is fixed annually in Chile for the sale of nitrate throughout the world. In fixing this nitrate price the Chilean producers, of course, take into account all the prospective supply of ammonium sulphate and all other nitrate competitors or substitutes; but once the price of nitrate is fixed for a year, then the price of ammonium sulphate is higher or lower, according as the current demand is less than or greater than the current supply in any district.

Many contracts are made with fertilizer manufacturers for the bulk of their supplies of ammonium sulphate. Such prices usually do not fluctuate widely, although at any particular time there may be contracts in force at widely different prices, depending upon the prospects in evidence at the time the contracts were made. The spot price of ammonium sulphate does, on the other hand, vary widely, being dependent mainly upon the supplies of this material and of Chilean nitrate that are available for immediate delivery.

LIQUID AMMONIA MARKET

Liquid ammonia for refrigeration and for various chemical uses is made by a number of companies which utilize gas works ammonia liquor as their raw material. Ammonia liquor from coke works also is so employed to a small extent. The market for liquid ammonia is, of course, decidedly limited and is much less than the potential supply of ammonia liquor. This market has been dominated by a relatively few ammonia companies but is now being invaded with considerable success by recently organized concerns making synthetic ammonia from the air.

As pointed out above, the fertilizer price has a large influence upon the price for ammonia liquor, and as the synthetic ammonia plants fixing nitrogen from air more and more invade the field this will be increasingly true. The synthetic plants can not yet produce ammonia as cheaply as the ammonia from coal, but their product is produced in gaseous form under high pressure, which makes it directly available for liquid ammonia. Thus the synthetic ammonia plant logically seeks first the liquid ammonia market. Especially during the stage of development of such plants, when they will operate even at considerable loss in order to gain the necessary chemical and engineering knowledge for further extension of plants and processes, it can be expected that synthetic ammonia will be sold at prices that will severely cut into the business of coke and gas works selling ammonia liquor.

AMMONIA FOR EXPLOSIVES

One of the important uses of ammonia liquor is in the manufacture of gunpowder. An acceptable ammonia liquor for this purpose is one that contains 25 per cent or more of ammonia, which means that it must have been concentrated much above the form in which liquor is originally recovered at the gas works. Powder liquor should contain as little as possible of sulphur, show no trace of tar, and be absolutely free from cyanide, as this last constituent gives an objectionable blue color to the finished ammonium nitrate used in the powder mixtures. Virtually all of the ammonia liquor purchased by powder companies is obtained through large producers or ammonia dealers rather than direct from the local gas works. Some large powder makers occasionally buy up the ammonia output of certain coke ovens or gas works, but then they must exercise a certain supervision over the quality of the liquor produced.

Like other users of ammonia liquor, the powder companies pay about as much per unit of ammonia contained as will correspond to the current market price for ammonium sulphate. This price, in turn, varies with the demands for the fertilizer market.

NEW AMMONIA CHEMICALS

At times the management of a coke works or large gas works finds it profitable to make other ammonia chemicals instead of ammonium sulphate. Ammonium chloride is one such compound that has been manufactured on a large scale in one or two localities. However, this compound can not be made quite as readily as the sulphate. The chloride solutions are much more corrosive, and direct reaction of the ammonia in the gas with hydrochloric acid is seldom practicable, because there is resulting loss of the acid by volatilization unless special precautions are taken to wash the gas with water after it is washed with acid. An indirect process is therefore used.

There is a large potential market for ammonium chloride, but the demand is now satisfied largely by imported salts, and the extent to which the domestic producer of ammonia will enter this field is simply a question of the relative profit in making chloride instead of sulphate.

Ammonium phosphate is another compound that could be made with very great advantage at a coke works instead of ammonium sulphate, provided the phosphoric acid needed were cheap enough. Numerous attempts are now being made to reduce the cost of this acid in the hope that it can replace sulphuric acid in this work. If the effort is successful, the product will be an ammonium phosphate, which not only contains nitrogen for plant food but also phosphorus, a second important plant food. Ammonium phosphate is eminently suited to fertilizer use and at a suitable price would find an almost unlimited market. In many respects it would be distinctly superior to ammonium sulphate, as the latter is somewhat unsuitable for use on certain soils or with certain crops and tends to exhaust the available lime in the soil. As yet, however, the possibility of using ammonium phosphate has not been realized commercially at all; realization will quickly follow the availability of cheap phosphoric acid.

Numerous other ammonium salts are of chemical importance, but none of these is used in such quantities as to represent an appreciable percentage of the total demand for the ammonia made from coal. From the standpoint of either the coke-oven or gas-works operator they are therefore a negligible factor in the market.

SUMMARY

Outstanding characteristics of the ammonia market of the country as a whole can be summarized as follows:

Many small gas works find it commercially unprofitable to recover and market either ammonia liquor or ammonium sulphate. Large coal-gas works usually sell most of the ammonia made in the form of ammonia liquor. Most by-product oven plants recover the bulk of the ammonia as ammonium sulphate, but a few of these plants make limited quantities of ammonia liquor.

Of the ammonia made from coal only a small and definitely limited part can be marketed as ammonia liquor. This liquor is used primarily for making liquid ammonia, aqua ammonia, powder liquor for explosives manufacturing, and similar chemical applications. As much of the ammonia is so marketed as can profitably be so employed.

The production of ammonia, by synthetic chemical processes, from nitrogen of the air has been developing rapidly in the last few years. In the near future ammonia liquor must meet serious competition from this source.

Ammonium sulphate is marketed chiefly for fertilizer use, but the sale is almost altogether through fertilizer companies, rarely direct by producers to fertilizer users.

Virtually all of the ammonium sulphate made in the United States is marketed by a single company as a selling agent for the large gas works or the coke-oven plant producing it. This company maintains a marketing service throughout the United States and abroad.

Ammonium sulphate as a raw material for fertilizer competes directly with Chilean nitrate, although the two are not directly interchangeable, because the dry mixer of fertilizers can rarely use ammonium sulphate and because Chilean nitrate can not be mixed with acid phosphate for ordinary " mixed " fertilizer. The market prices of the ammonium sulphate and the Chilean nitrate are, however, intimately interrelated, since the farmer finds the two sources of inorganic nitrogen equally satisfactory per unit of plant food contained.

Some unsatisfied market for ammonia chemicals, such as ammonium chloride, can probably be met by ammonia from coal in the near future instead of by imports of these chemicals as at present. Most important developments would follow the availability of cheap phosphoric acid, since this would permit manufacturing ammonium phosphate instead of ammonium sulphate, and thereby furnish ammonia in a form more valuable for fertilizer use.

LIGHT-OIL USE AND VALUES

HISTORY OF LIGHT-OIL PRODUCTION

The vapors of benzol, toluol, and other similar hydrocarbons that occur in a crude coal gas may be condensed partly in the tar, may be allowed to remain in the gas which is sold or used, or may be almost completely removed in a separate part of the plant by washing the gas with a petroleum oil. These hydrocarbon compounds, which are liquids at ordinary temperatures, are called "light oils" because they are lighter than water.

Originally light oils were recovered from coal gas only by distillation of the coal-gas tar, but with a recognition of their chemical importance some coke-oven plants recovered them separately even before 1914. In that year, with the tremendous increase in demand for high explosives, came a corresponding increase in demand for toluol and benzol from which were made TNT and picric acid. As a consequence, long before the United States entered the World War virtually every coke-oven plant and many of the larger gas works were recovering and marketing either crude or refined light oil or light-oil products. (See Table 90 for data on production of light oil by coke ovens.)

TABLE 90.—*Production of light oil and derivatives at by-product coke plants, 1918–1924*

Product	Production	Sales		
		Quantity	Value	Average value
1918				
Crude light oil……gallons..	[a] 87, 222, 450	3, 764, 272	$963, 042	$0. 256
Secondary light oil……do….	339, 644	121, 191	15, 472	. 128
Benzol……do….	44, 804, 900	43, 441, 980	11, 966, 367	. 275
Toluol……do….	8, 861, 948	8, 541, 366	12, 249, 702	1. 434
Solvent naphtha……do….	3, 540, 162	3, 123, 815	439, 983	. 141
Other oils……do….	636, 707	571, 752	53, 880	. 094
	[b] 58, 183, 361	59, 564, 376	25, 688, 446	. 431
Naphthalene:				
Crude……pounds..	10, 614, 799	10, 403, 758	287, 581	. 028
Refined……do….	5, 472, 699	5, 486, 689	362, 648	. 066
	16, 087, 498	15, 890, 447	650, 229	. 041
1919				
Crude light oil……gallons..	[a] 92, 473, 409	----------	----------	----------
Benzol:				
Crude [c]……do….	44, 060, 970	44, 673, 554	7, 860, 093	. 176
Refined……do….	17, 006, 532	18, 403, 909	3, 783, 552	. 206
Toluol: Refined……do….	1, 160, 136	1, 353, 827	355, 990	. 263
Solvent naphtha……do….	3, 920, 489	3, 625, 978	552, 853	. 152
Other refined oils……do….	575, 885	127, 483	18, 358	. 144
	[b] 66, 724, 012	68, 184, 751	12, 570, 846	. 184
Naphthalene:				
Crude……pounds..	3, 579, 998	4, 038, 455	82, 244	. 020
Refined……do….	2, 763, 271	2, 663, 585	109, 120	. 041
	6, 343, 269	6, 702, 040	191, 364	. 029

[Footnotes at end of table]

TABLE 90.—*Production of light oil and derivatives at by-product coke plants, 1918–1924*—Continued

Product	Production	Sales		
		Quantity	Value	Average value
1920				
Crude light oil ---------- gallons--	[a] 109, 709, 915	1, 067, 045	$126, 158	$0. 118
Benzol:				
Crude ---------- do----	8, 747, 572	1, 510, 420	401, 296	. 266
Refined ---------- do----	16, 977, 556	15, 720, 356	4, 096, 527	. 260
Motor fuel[d] ---------- do----	57, 645, 462	55, 764, 265	12, 644, 931	. 227
Toluol:				
Crude ---------- do----	287, 142	----------	----------	----------
Refined ---------- do----	2, 710, 649	2, 470, 364	740, 722	. 300
Solvent naphtha ---------- do----	5, 678, 525	4, 695, 464	851, 048	. 181
	[b] 92, 046, 906	81, 227, 914	18, 860, 682	. 232
Naphthalene:				
Crude ---------- pounds--	11, 246, 807	11, 507, 703	307, 999	. 027
Refined ---------- do----	2, 921, 282	2, 941, 059	179, 975	. 061
	14, 168, 089	14, 448, 762	487, 974	. 034
1921				
Crude light oil ---------- gallons--	[a] 76, 917, 269	2, 433, 078	240, 111	. 099
Benzol:				
Crude ---------- do----	1, 494, 329	1, 536, 312	343, 463	. 224
Refined ---------- do----	4, 912, 131	5, 302, 709	1, 268, 258	. 239
Motor benzol ---------- do----	48, 052, 882	50, 022, 573	8, 966, 686	. 179
Toluol:				
Crude ---------- do----	26, 529	26, 529	4, 410	. 166
Refined ---------- do----	942, 982	808, 964	228, 968	. 283
Solvent naphtha ---------- do----	3, 822, 776	2, 881, 656	510, 509	. 177
Other miscellaneous products ---------- do----	590, 173	291, 635	12, 310	. 042
	[b] 59, 841, 802	63, 303, 456	11, 574, 715	. 183
Naphthalene:				
Crude ---------- pounds--	2, 827, 756	1, 652, 466	40, 659	. 025
Refined ---------- do----	115, 229	331, 057	18, 676	. 056
	2, 942, 985	1, 983, 523	59, 335	. 030
1922				
Crude light oil ---------- gallons--	[a] 101, 437, 555	5, 138, 095	630, 768	. 1228
Benzol:				
Crude ---------- do----	2, 666, 177	2, 665, 889	698, 437	. 2620
Refined ---------- do----	10, 419, 504	9, 590, 459	2, 736, 944	. 2854
Motor benzol ---------- do----	57, 025, 699	54, 930, 203	10, 491, 309	. 1910
Toluol:				
Crude ---------- do----	38, 159	3, 938	652	. 1656
Refined ---------- do----	1, 955, 119	1, 906, 122	556, 363	. 2919
Solvent naphtha ---------- do----	2, 983, 858	2, 861, 482	538, 512	. 1882
Other light-oil products ---------- do----	580, 058	212, 712	14, 949	. 0703
	[b] 75, 668, 574	77, 308, 900	15, 667, 934	. 2027
Naphthalene:				
Crude ---------- pounds--	6, 107, 742	3, 298, 851	52, 103	. 015
Refined ---------- do----	1, 810, 972	1, 589, 084	79, 149	. 0498
	7, 918, 714	4, 887, 935	131, 252	. 0269
1923				
Crude light oil ---------- gallons--	[a] 135, 647, 175	6, 539, 368	683, 545	. 105
Benzol:				
Crude ---------- do----	4, 503, 428	4, 348, 400	768, 486	. 177
Refined ---------- do----	12, 364, 043	12, 375, 782	3, 070, 751	. 248
Motor benzol ---------- do----	80, 467, 883	80, 480, 326	13, 145, 833	. 163
Toluol:				
Crude ---------- do----	37, 777	6, 097	978	. 160
Refined ---------- do----	2, 847, 517	2, 628, 686	765, 052	. 291
Solvent naphtha ---------- do----	4, 162, 178	3, 399, 904	608, 084	. 179
Other light-oil products ---------- do----	439, 253	198, 098	10, 605	. 054
	[b] 104, 822, 079	109, 976, 661	19, 053, 334	. 173
Naphthalene:				
Crude ---------- pounds--	11, 872, 007	10, 047, 427	174, 216	. 017
Refined ---------- do----	1, 139, 922	1, 198, 206	65, 483	. 055
	13, 011, 929	11, 245, 633	239, 699	. 021

[Footnotes at end of table]

TABLE 90.—*Production of light oil and derivatives at by-product coke plants, 1918–1924*—Continued

Product	Production	Sales		
		Quantity	Value	Average value
1924				
Crude light oil........gallons..	[a] 128, 956, 955	7, 840, 582	$652, 467	$0. 083
Benzol:				
Crude........do....	3, 856, 908	3, 860, 408	831, 419	. 215
Refined........do....	14, 278, 117	13, 880, 200	2, 905, 237	. 209
Motor benzol........do....	73, 768, 811	72, 921, 224	11, 066, 652	. 152
Toluol:				
Crude........do....	234, 244	245, 079	51, 041	. 208
Refined........do....	2, 951, 187	2, 986, 423	718, 641	. 241
Solvent naphtha........do....	4, 474, 220	3, 884, 585	724, 874	. 187
Other light-oil products........do....	1, 364, 528	1, 077, 842	78, 934	. 073
	[b] 100, 928, 015	106, 696, 343	17, 029, 265	. 160
Naphthalene:				
Crude........pounds..	8, 378, 666	7, 891, 116	116, 305	. 015
Refined........do....	13, 302	327, 957	11, 903	. 036
	8, 391, 968	8, 219, 073	128, 208	. 016

[a] The greater part of the crude light oil produced was refined on the premises to make the derived products listed. The quantities so refined were 106,564,417 gallons in 1920; 75,760,334 in 1921; 98,432,100 in 1922; 132,517,389 in 1923; and 125,580,743 in 1924.
[b] Total gallons of derived products.
[c] Mainly motor fuel containing varying percentages of other constituents.
[d] The benzol content of motor fuel ranged from 50 to 100 per cent.

At the close of the war period the tremendous demand that had resulted in very high prices for light-oil products ceased. The bulk of this material had, therefore, to seek a new market, and it found this outlet in the field of motor fuels. To a very small extent motor benzol, which is a partly-refined light oil, is used as a motor fuel alone; but commonly it is used only for blending with gasoline or with gasoline and alcohol to make the specially-blended motor fuels which have been so popular during the past few years. Figure 28 shows the production of benzol of all grades by sources, for 1918 and 1922. The extent to which light oil is recovered is determined by the prices obtainable in this market.

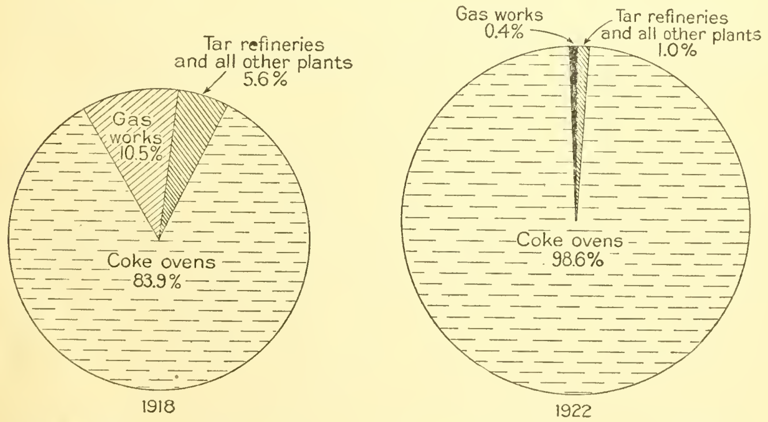

FIGURE 28.—Production of benzol of all grades, by sources, 1918 and 1922

ECONOMICS OF LIGHT-OIL RECOVERY

Only a small percentage of the potential production of light oil and the light-oil products is needed in the chemical industries and for use as solvents. The balance of the output is used in blended motor fuels, and the price obtainable for this use fixes the general market price. These blended motor fuels are worth slightly more per gallon because of the greater mileage obtainable from them and because of other advantages secured with them, such as reduced detonation, especially during cold weather. However, the excess above the gasoline price which the motorist will pay for such fuel is small, and this limited-price difference correspondingly limits what the blender of motor fuels can pay for light-oil products.

During the war there was no doubt as to the economic advantage to the gas-works or coke-oven operator in recovering these products. It was often possible to write off the whole investment in the new equipment needed for recovery within the first 12 months of operation; and it was very fortunate that this was true, for many light-oil plants were built then which could not now be justified on the basis of the market price of these commodities.

The price of crude light oil at the producer's plant follows closely the wholesale price for ordinary grades of gasoline. The fluctuations are generally not so great as those in gasoline price, as virtually all of the light oil is sold under contract; but, in general, there is a close parallelism in price. As a matter of fact, one can say roughly that the two prices are equal, since to partly refine the crude light oil to the stage of motor benzol costs approximately as much as is represented by the difference in value per gallon of the motor benzol and the gasoline with which it is blended.

The following paragraphs discuss the different conditions that arise in coke works and in coal-carbonizing plants making gas for city supply. On consideration of these two cases the reader will find that under one set of circumstances complete light-oil recovery is usually profitable, but that under the others it is rarely so.[5]

SALE OF LIGHT OILS BY COKE WORKS

All but 8 or 10 by-product oven plants operating in the United States during recent years have regularly recovered light oil and marketed either it or its products. This fact is conclusive evidence that under present industrial conditions it is more profitable to remove the light oil from the gas than to burn the light oil as a constituent of the gas, except under special conditions. A brief consideration of the relative market price of the light oil sold and of the contribution that this light oil might make to the value of the gas if not removed will explain this practice.

Removal of the light oils from the gas reduces the heating value appreciably, usually about 5 per cent of the total. If the light oil remains in the gas, it contributes to the market value in proportion to the heat that it gives on burning. Thus, a gallon of crude light oil, which contains about 130,000 B. t. u., would give just this much heat if left as a vapor in the gas. Commonly the gas from by-product ovens sells at the producer's works for about 30 cents per million heat units contained; but if the light oil is scrubbed from the gas and sold as a liquid, then the market price is at least $1 per million heat units contained, or over three times that for the gaseous heat units. Thus, if cost of recovery is not too great, there is obvious advantage in recovering the light oil and selling it separately.

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[5] The recovery of light oil at coke works has been described in considerable detail in Bureau of Standards Technologic Paper 117, Toluol Recovery, by R. S. McBride, C. E. Reinicker, and W. A. Dunkley. Therefore, it is unnecessary in this report to discuss at all the plant methods used for separating the light-oil vapors from the crude gas or for refining the crude light oil into its several products. Those who wish statistics regarding the extent to which this material is recovered should consult the annual volumes of Mineral Resources for data regarding production and the annual reports of the United States Tariff Commission for data regarding the refined products made from the light oil.

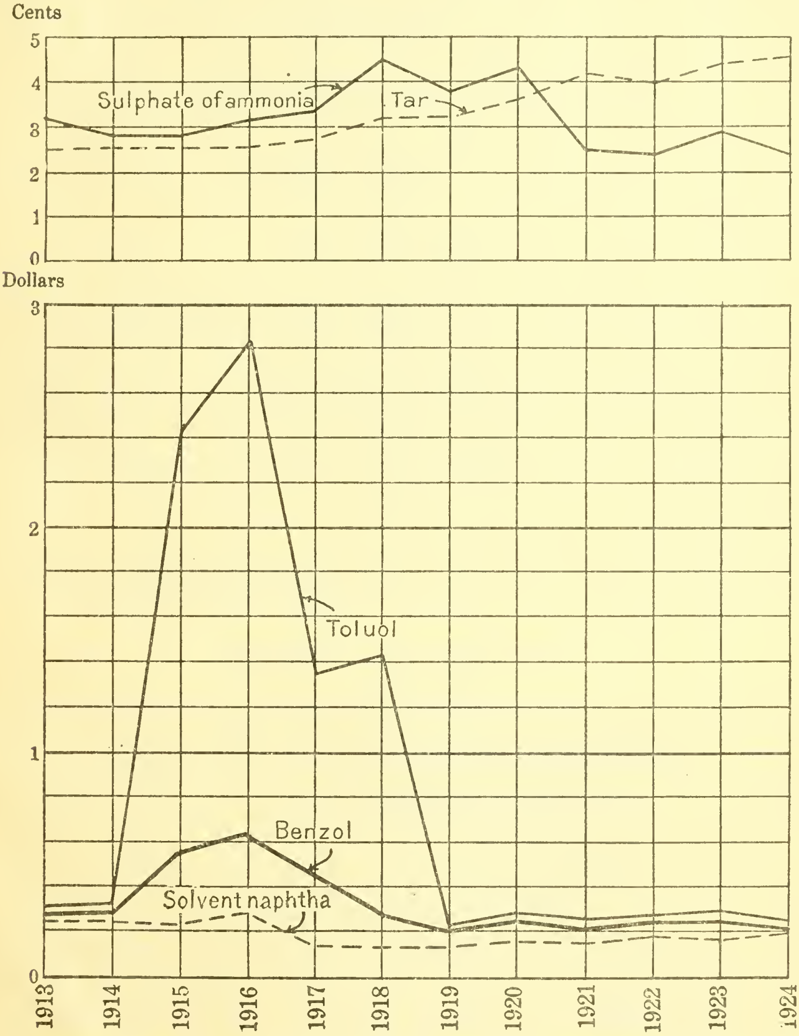

FIGURE 29.—Average receipts per unit of the principal refined light oils and other by-products sold, 1913–1924

Figure 29 gives average receipts per unit of principal light oils and other by-products sold by coke-oven operators from 1913 to 1924.

LIGHT-OIL SALES BY GAS WORKS

If the oven gas or retort gas is to be used for city distribution, it generally is worth decidedly more, even at the producer's plant, than is obtained at the typical by-product oven. The few by-product ovens that do not recover light oil and all the retort coal-gas plants are selling the gas for city supply under conditions that make it worth from two to four times as much at the producer's plant as was assumed in the above comparison for coke works. Hence, at such plants the light-oil vapor in the gas is probably worth from 60 cents to $1.20 per million heat units it contributes. In other words, the light-oil vapor in the gas is worth as much in that form as if separated out and sold as a liquid. Obviously, under such conditions the plant operator has no financial inducement to remove the light oil, and usually he does not do so.

During the war period there were about 40 companies engaged directly in city-gas manufacture who did operate light-oil plants; but as early as 1920 all but 12 of these plants had ceased operation, and most of the equipment had actually been dismantled and removed. Under present conditions only 3 or 4 per cent of the total light-oil production of the country comes from the city-gas industry. All the rest comes from by-product ovens operated for metallurgical coke supply. It is doubtful whether this condition will change for many years to come; certainly it will not be changed until the market value of light oil is relatively very much greater compared with the market value of the gas than it is to-day.

Figure 30 gives the source of the supply of naphthalene available in the United States, 1918 to 1924, and Figure 31 the value of the several by-products per ton of coke produced, 1913 to 1924.

MARKETING OF LIGHT OIL

Of late years the practice of refining the light oil at the producer's plant, or in affiliated works, has increased until in one recent year nearly 98 per cent of the entire production of the country was so refined. Motor benzol is, of course, the chief product made. In 1923 this product alone accounted for 75 per cent of the total sales of light-oil derivatives, and some of the crude benzol was undoubtedly also used as a motor fuel. Most of this motor benzol was sold directly by producers to petroleum refiners or others making blended motor fuels. Usually the sales were by long-time contracts, since plans for prompt shipment are necessary in order that the producer will not accumulate stocks beyond the capacity of his storage tanks, and the user must, of course, have regular supplies of the benzol in order to maintain uniformity in his blended motor fuel.

There are no figures that permit accurate estimate of the extent to which light-oil motor benzol or refined products, such as pure benzol, toluol, and solvent naphtha, are sold on the spot market; but it is safe to assume that from the standpoint of the original producer the spot market is but a small factor in determining sales realization. As pointed out before, the producer can seldom take advantage of the spot market regularly, and he certainly can not depend exclusively upon it for the disposition of his product. Moreover, over any

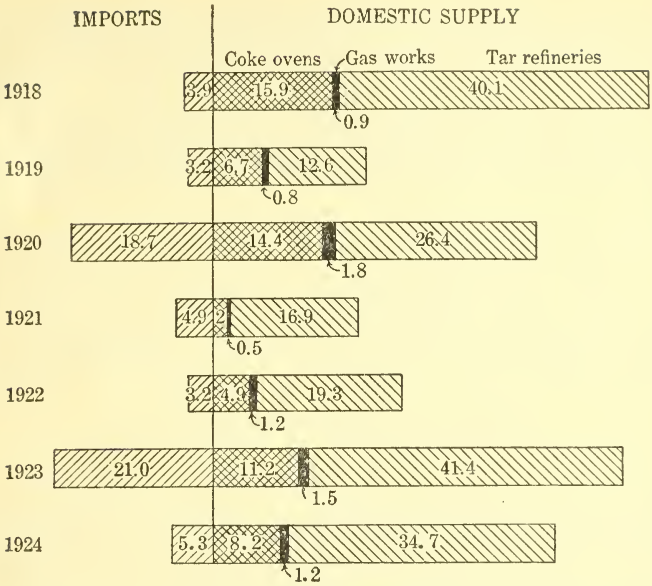

FIGURE 30.—Source of the supply of naphthalene available in the United States, 1918–1924

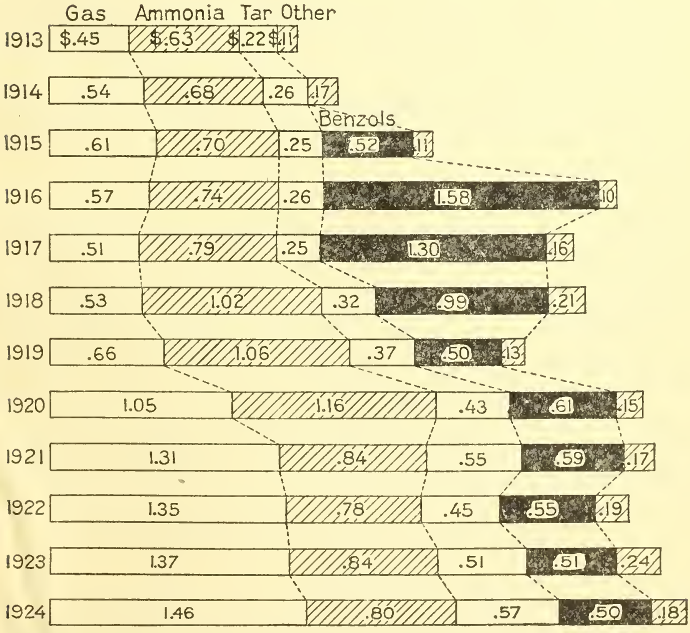

FIGURE 31.—Value of the several by-products per ton of coke produced, 1913–1924

extended period the margin between "spot" prices and the contract market prices for motor benzol is necessarily very small. A differential of a few cents per gallon would be sufficient to bring a veritable flood of these products, all of which can be produced in quantity on very short notice at any light-oil plant equipped for refining. The purchaser of light-oil products for other purposes than motor-fuel blending knows these facts, and except for occasional very urgent purchases in small quantities he is unlikely to bid up the price materially.

Marketing of the light-oil products used in the chemical industries as solvents or as "coal-tar crudes" for further chemical manufacturing is a subject that takes one far afield from the direct interests of the coal-products manufacturer. It is, in fact, a part of the chemical marketing problem of the country, rather than a part of the marketing of coal products.

PRICES OF LIGHT-OIL PRODUCTS

In Figures 32 and 33, prepared, like many of the others used in this report, by F. G. Tryon, is given a comparison of prices of tank-wagon gasoline with prices of pure benzol and spot prices for 90 per cent benzol in New York. The price of pure benzol, although higher than that of gasoline, follows rather closely the up and down price movements of the gasoline. The spot price for crude benzol is, of course, subject to wider fluctuations and is, on the average, distinctly lower than the market price of the pure product. Unfortunately, there are no corresponding data for motor benzol, but general information shows that the price of this commodity follows even more closely the gasoline market than do the prices of either of the two commodities charted.

Prices for crude light oil and for other commodities than motor benzol are of less general interest than those for the last-named commodities. They are, however, briefly summarized in Table 59, page 646.

These data are also shown graphically in Figure 29 (p. 723), which makes very evident the abnormal price trend during the period of the World War. During the early stages of that conflict the price of toluol, for example, advanced from 30 cents a gallon to extravagant figures, some sales being made as high as $6 per gallon. Similarly, benzol, which had usually sold at a little lower price than toluol, athough not quite attaining such dizzy heights, was frequenty marketed at figures 5 to 10 times those of the immediate pre-war period. After the United States entered the war the prices were regulated, the Government taking all toluol at $1.50 per gallon and controlling the benzol distribution at corresponding figures.

FUTURE DEVELOPMENT OF LIGHT OILS

The motor-fuel market is capable of absorbing all of the motor benzol that can possibly be made from the carbonization of coal. Actually the production of benzol available for motor fuel is only 1 per cent of the current gasoline output. Even if all of the bituminous coal which is mined were carbonized, the total potential motor-benzol production would be less than one-sixth of the motor-fuel requirement of the country. The market of the future for this group of coal products seems, therefore, to be practically unlimited.

For reasons pointed out in early sections it can be expected that light-oil products will be made from all coal which is carbonized where coke is the primary product and where the gas is not to be sold for city distribution. On the other hand, if the gas is the primary object of coal processing, or if the gas made at a coke works is sold for city supply one can expect in general that the light oil will not be recovered from the gas.

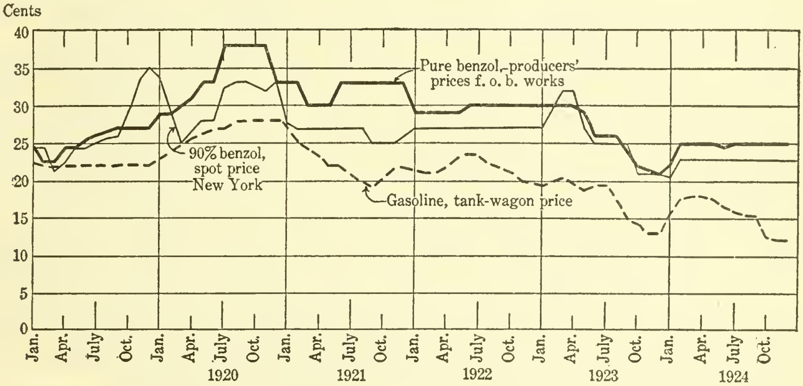

FIGURE 32.—Spot price of 90 per cent benzol in New York, producers' prices of pure benzol f. o. b. works, and tank-wagon price of gasoline, by months, 1919–1924

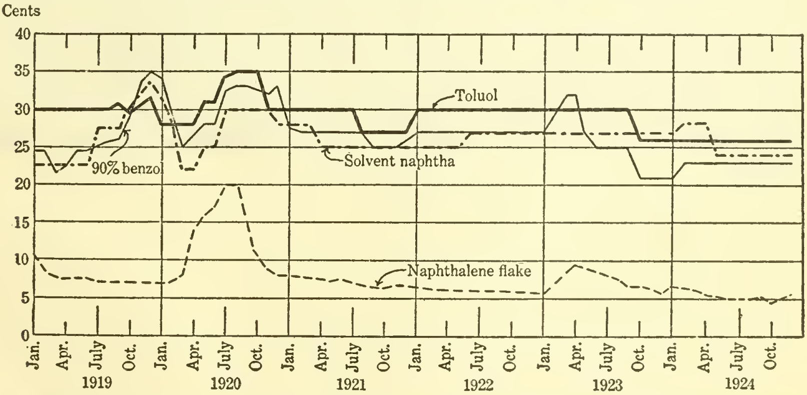

FIGURE 33.—Spot prices of 90 per cent benzol, toluol, solvent naphtha, and flake naphthalene in New York, 1919–1924

SUMMARY

The light-oil situation can be summarized as follows:

During the war period light-oil production was profitable to supply toluol and benzol to make explosives, even where the gas was to be sold for city distribution. However, under peace-time conditions light oil is seldom recovered from the gas to be sold for city supply. Where gas is not sold for city distribution, recovery of the light oil is usually still profitable.

Almost all the light oil produced at by-product ovens is refined by the producer; the small remainder is refined in the very few plants where crude light oil is purchased. The chief products of light-oil refining are benzol (as motor benzol, crude benzol, or pure benzol), toluol, solvent naphtha, and naphthalene. Motor benzol constitutes about 75 to 80 per cent by bulk of all the refined products.

Most of the motor benzol is sold by the producer for blending with gasoline to make a blended motor fuel for automobiles. For this purpose the motor benzol is worth a few cents a gallon more than gasoline. The market for blended motor fuel is practically unlimited, but the price obtainable is invariably only a few cents per gallon above the current local price for standard grades of gasoline. Thus the market price for light oil or motor benzol is more or less permanently defined by the market price of gasoline.

Prices for other light-oil products vary widely in the spot market and to a small extent in the contract market. However, no very large difference can prevail for long between the price of motor benzol and that of the more completely refined products without inducing production of large quantities of these chemicals.

The market for light-oil products in the chemical industries is so limited relative to the production already available that these markets can safely count upon ample supplies at prices that will be fixed by the gasoline market more than by any other consideration. Moreover, there seems no likelihood that these prices will advance much more above gasoline than they are to-day, for the price of blended motor fuel will undoubtedly be permanently limited to a few cents above the price for standard grades of gasoline in the same locality.

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